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447 — *Journal Section of the American Society of Heating and Ventilating Engineers*

Control of the air in industry helps to win the battle of production.

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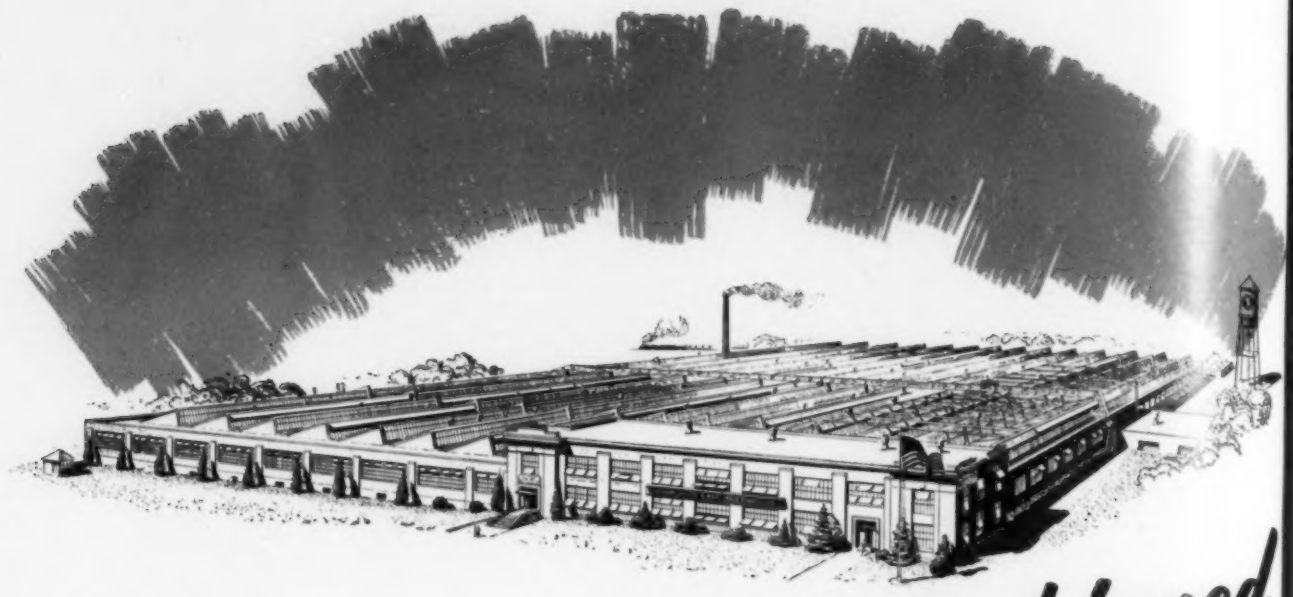

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PACIFIC WAR DEMANDS MORE FUEL OIL

Military requirements for petroleum products for the war against Japan are almost as great as the requirements for the two front war, according to a report of the Director of War Mobilization and Reconversion dated July 1. The intensification of naval warfare and the oceanborne transportation of troops and equipment over vast distances do not permit any great increase in allowances for civilians.

Increased use of shipping in the Pacific war has shifted the type of requirements from gasoline to fuel oil. As a result, fuel oil available for civilians for the 1945-46 heating season is not likely to be any greater than during the previous season, says the report. Only further reductions in military and export requirements or an increase in the supply of petroleum products from foreign sources for military use will permit modification of present rationing controls on fuel oil or gasoline.

In view of the heavy requirements attending the war with Japan and the lack of manpower for producing and distributing fuel on an adequate basis, coal and coke may be seriously short next winter, the report continues. The Solid Fuels Administrator for War has found it necessary to limit deliveries of eastern soft coal, most sizes of anthracite, and byproduct coke for domestic use to not over 80 per cent of a normal supply next winter. No increase in the quota appears possible at this time without depriving industry of coal needed for war production and reconversion to the manufacture of civilian goods.

SFA PUSHES "PREPARE FOR WINTER" CAMPAIGN

Solid Fuels Administrator Harold L. Ickes informed the solid fuels producing and distributing industries last month that his office has requested the fuel conservation directors of 25 states to launch local drives to get the people of each community to "Prepare for Winter" this summer. The conservation directors, appointed by the respective governors at the administrator's request several months ago, are located in most of the states where fuels controlled under SFA's regulation No. 26 are widely used.

The purpose of this project is to stimulate each community to carry on a vigorous drive to make necessary preparations this summer to keep warm on the war-reduced fuel supplies that will be available next winter. These preparations, says the SFA, should include:

1) Winterproofing homes and buildings. Insulating walls, ceilings, and roofs. Installing storm doors and windows, weatherstripping openings. Caulking all cracks in buildings, including those around doors and windows. Making other repairs necessary to keep heat from escaping.

2) Placing heating plants in efficient working condition. Cleaning and repairing furnaces, pipes, chimneys, and other equipment. Installing heating controls wherever possible.

3) Filing consumer declarations and orders for fuel now. Storing whatever amount of fuel dealers can provide, at the time it can be delivered. Taking dealers' advice as to the kind and size of fuel to store, and accepting alternative fuels when favorite kind or size is not readily available.

State conservation directors are urged by the SFA to do everything they can to have such a drive conducted in every community possible. It is suggested that the aid of an appropriate local organization, such as the chamber of commerce or conservation committee (where available), be enlisted to organize the drive and put the necessary "push" behind it. The local organization should perform the following functions:

1) Encourage business concerns selling fuel conservation services and materials (including insulation, storm sash, weatherstripping, caulking, building repairs, furnace cleanup and repair and conditioning of other heating equipment, heating controls, heat-saving building repairs, FHA and other fuel conservation loans, etc.) to carry on the most vigorous advertising and merchandising programs possible in view of local conditions.

2) Issue public appeals, via press, radio or other appropriate media, to make the public conscious of the need to "Prepare for Winter" this summer, and to acquaint people with what should be done.

THE Editor's Pages

REMA MARKS 10TH ANNIVERSARY

Organized by less than a dozen companies in 1935 and now including 80 manufacturers of mechanical refrigeration and air conditioning parts, units, and complete systems, the Refrigeration Equipment Manufacturers Association observed its 10th anniversary August 15 with a summer meeting of the board of directors in Marinette, Wis.

The program included a discussion of the association's plans for the future, involving a resumption of annual conventions and REMA's all-industry refrigeration and air conditioning shows as soon as wartime conditions permit, and further emphasis on educational, public relations, and promotional activities.

While the 10 years which have elapsed since the REMA was formed have marked some of the most important developments in the history of mechanical refrigeration and air conditioning, the next decade, in the opinion of association officials, will see even more far reaching progress in both fields.

THE Editor's Pages

COAL MEN STUDY RESIDENTIAL GROUP HEATING

Members of the technical advisory board of Bituminous Coal Research, Inc., met last month with the fuels division staff of the Battelle Memorial Institute to review current research activities of the coal industry and to make plans for continuing laboratory work on a number of major projects.

Preliminary findings were revealed by the research engineers working on residential group heating, a plan for heating a number of houses from a single, central, stoker fired plant. Their report showed "that by district heating, the ultimate convenience in comfort heating is possible with coal in community housing projects, and at costs less than for heating individual homes with competing fuels."

A report that highlighted the meeting indicated that probably more than 500 railroad locomotives have been equipped with overfire jets, a BCR development to eliminate smoke.

The group inspected laboratory projects under way for BCR at Battelle, including the smokeless stove, the inverted underfeed stoker, tests for rating warm air furnaces, a smokeless handfired furnace, a flow model of locomotive air supply, and other tests.

MOVIE THEATER USES RADIANT HEATING

The first motion picture house in the country to install radiant heating for its auditorium is the 350 seat Jewell Valley theater, Jewell Valley, Va., according to the A. M. Byers Co. Opened in the fall of 1944, this theater found its radiant heating system "very satisfactory" in the severe winter that followed. The theater is basementless, and radiant heating was selected to eliminate the danger of cold or damp floors. Utilization of all the floor area was another inducement, the system being completely concealed beneath the floor.

The system is composed of 1¼ in. wrought iron pipe formed into a grid, through which hot water is circulated by a 3 in. pump. The grid coils were fabricated on the site by means of gas welding. They are placed on 1 in. strips of semi-rigid insulation board resting on a bed of crushed stone. Over the grid, which is fed from a 2½ in. pipe main and 2 in. manifolds, a 5 in. concrete slab was poured.

The coils were pitched to provide drainage, and were tested for 24 hr under 200 psi of both air and water pressure before the slab was poured. The system utilizes a hot water boiler which also serves radiators in other parts of the structure. Mixing valves were installed to bypass part of the return water into the supply.

PLAN NOW TO CONSERVE FUEL, DR. WINSLOW WARNS

When the new heating season opens, the need for better utilization of fuel for heat and power confronts every user of heating equipment, whether it be for a residence, industrial plant, or public building, warns Dr. C.-E. A. Winslow, president of the American Society of Heating and Ventilating Engineers. With higher priced fuel and a smaller available supply due to wartime conditions, it is essential for every building owner and operator to plan during the summer season for inspection of equipment and replacement of defective parts, and to follow through by proper operating methods when the plant is started in the fall.

Dr. Winslow points out that the society, at its laboratory in Cleveland and through special grants to universities, is carrying on investigations looking toward ultimate greater efficiency and economy in heating and air conditioning.

MAYOR PROCLAIMS FURNACE CLEANING WEEK

Supporting the national fuel efficiency program of the U. S. Bureau of Mines, Mayor Edward J. Kelly of Chicago designated the week of July 22-28 as furnace cleaning week, and urged all plant and building owners and managers, and householders, to clean and repair all types of heating plants.

HERBERT J. WINN, TAYLOR CHAIRMAN, DIES

Herbert J. Winn, chairman of the board of the Taylor Instrument Companies, died unexpectedly at his home, Rochester, N. Y., June 27. He would have been 75 on July 12. Mr. Winn began his career with the company in 1893, starting as a "boy of all work" and becoming over the years one of the country's great industrialists.

HARRY R. CLARAGE HEADS FAN COMPANY

Harry R. Clarage has been elected president of the Clarage Fan Co., succeeding Roland R. Ward who died June 21, and Robert J. Wasson has been elected to the board of directors and chosen vice-president and general manager. Both Mr. Clarage and Mr. Wasson have held important sales engineering and administrative positions in the company since the early twenties. Mr. Clarage is the son of Charles Clarage, founder of the business.

HORACE D. CAMPBELL IS DEAD

Horace D. Campbell, who retired as president and general manager of the Campbell Heating Co. on June 1 after 50 years in that position to become chairman of the board, died on June 25, three days before his 76th birthday. He was the son of the founder of the business, and two of his sons are connected with the business: Lt.-Col. Bowen Campbell, president and general manager, now with the Army in Germany, and Angus Campbell II, vice-president and sales manager.

ROBERT H. GARDNER MANAGES SALES

Robert H. Gardner has been appointed general manager of sales of the A. M. Byers Co., President L. F. Rains announced last month, succeeding the late Myron J. Cisniecki, who died June 18. At the same time, the appointment of H. R. Rowland as assistant general manager of sales was announced.

Heating Piping & Air Conditioning

with which is merged the Aerologist

Design, Installation, Operation, and Maintenance: Industrial, Commercial, Institutional, and Public Buildings

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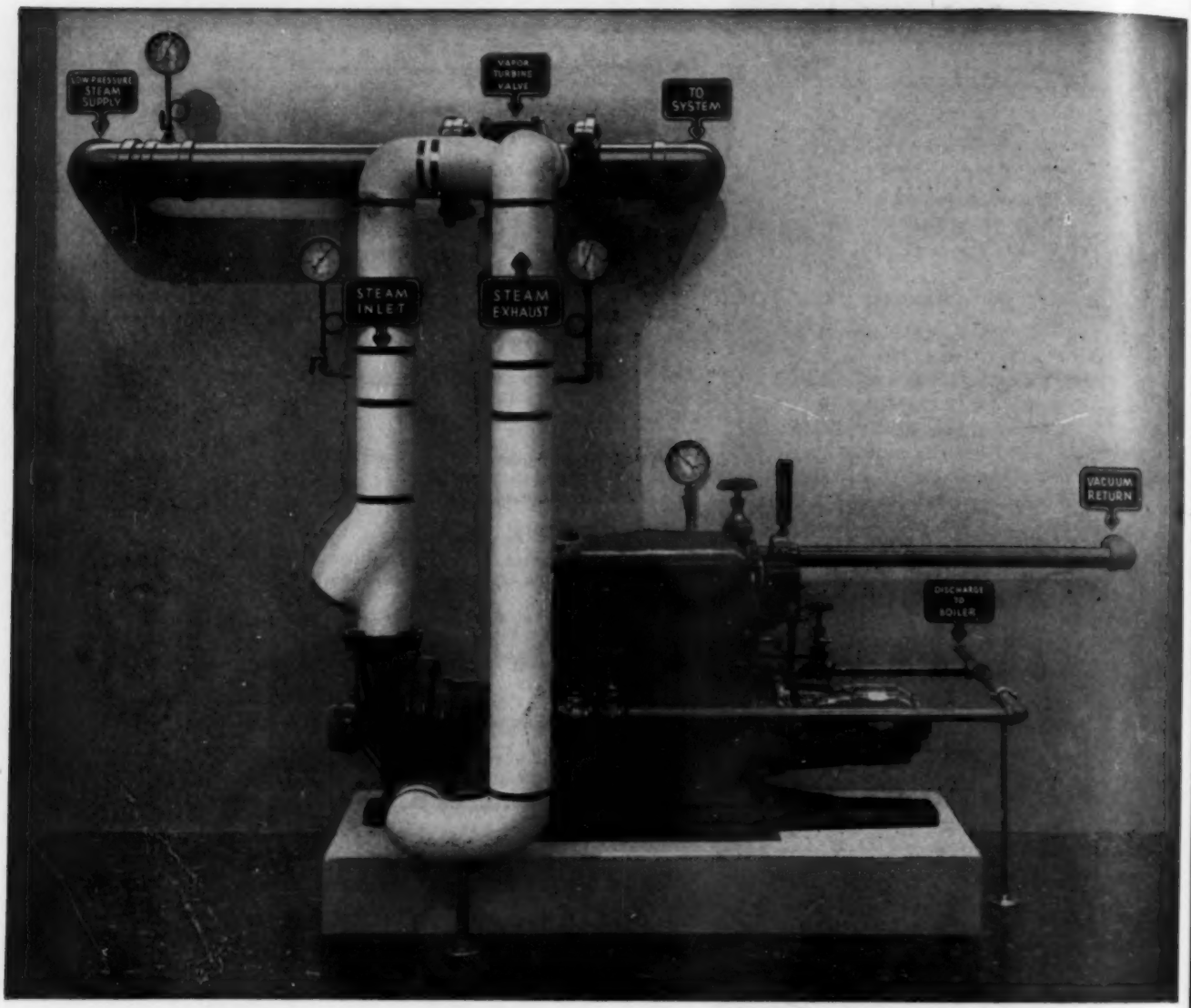
Interrupted Electric Service will not stop this NASH Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

205-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

Organizing Operation & Maintenance of Heating and Ventilating Systems

By S. F. Schultz, Heating and Ventilating Engineer
Fisher Cleveland Aircraft Div., General Motors Corp.

THE MAIN ASSEMBLY plant of the Fisher Aircraft Plant No. 2, Cleveland, Ohio, is a "blackout" type of building, which necessitated mechanical ventilation. For construction economy the heating system was incorporated with the ventilating system. The result is a large forced air heating job. For the past two summers the ventilating system has been operated to take advantage of the cool night air to lower temperatures in the plant.

The main assembly plant, with which this discussion will deal mostly, has approximately 2,500,000 sq ft of floor area and 78,117,000 cu ft. The totals are made up as follows:

	Sq Ft	Cu Ft
Basement—excavated part only	833,083	7,549,000
Main floor	1,250,963	62,080,000
Balcony	415,954	8,488,000

The other buildings are not of the blackout type, and have steam radiation heating or unit heating. The administration building is connected to the main assembly plant by a tunnel, while all other buildings are separated.

Fig. 1 shows the location of the heating and ventilating equipment in the basement of the main assembly plant. Only the cafeteria, offices, and hospital areas are excavated. The east and west corridors are 25 ft wide, and the north and south corridors are 75 ft wide. The letters and numbers on the margin of Fig. 1 show the column locations, and are very beneficial in locating complaint calls.

There is a total of 58 heating and ventilating units located along the corridors and the perimeter of the building. Those units located along the east and west walls marked with an "X" are the chief source of make-up air, and have two oil fired heating units attached to the plenum chamber. Fig. 2 shows a typical heating unit installation each of which has a minimum of 850,000 Btu output; four of the units have as much as 1,500,000 Btu output each.

All of the units located along the corridors depend upon recirculated air, and have a single heating unit attached to the plenum chamber with 750,000 Btu output capacity. Fig. 3 shows one of these installations.

Most of the exhaust fans are on the roof. There is a total of 136 such fans of which 104 are of uniform size, exhausting approximately 23,000 cfm; the balance exhaust anywhere from 1000 to 30,000 cfm. However, during the summer, some of these fans on the roof are reversed to increase the air delivery to the balcony area. Fig. 4 shows the arrangement of the exhaust fans on the roof.

A LITTLE time spent in working out procedures for the operation and maintenance of a large heating and ventilating system is repaid in the results achieved. Such a procedure should allow for the handling of complaints from the occupants of the building — including both "justified" and "unjustified" criticisms. . . . Mr. Schultz describes here the heating and ventilating installations for a factory having approximately 2½ million square feet of floor area, tells how the equipment is operated and maintained, and discusses the handling of employee complaints. An interesting feature is the plotting of all complaints on a comfort chart "squawk sheet," and the use of air velocity meters to explain the conditions maintained to anyone who has registered a complaint.

How System Operates

The air is drawn into the plenum chamber through 4 in. of filters by a double inlet conodial fan. During the heating season the blower operates at 215 rpm, delivering approximately 25,000 cfm, and is run from a 1½ hp motor. In the summer the blower is operated at 510 rpm, delivering approximately 60,000 cfm, and is run from a 20 hp motor. Fig. 5 shows a view within one of the plenum chambers.

After the air has been drawn into the plenum chamber, part of it is forced across the heating unit and redelivered back into the plenum chamber from whence it is forced to the area to be heated. To control the temperatures in the plant, ductstats were installed in the supply air ducts and are set to maintain a discharge temperature in proportion to the outdoor temperatures.

The units located along the perimeter of the building carry practically the entire heating load. The average temperature in the ducts seldom has to be carried above 80 F.

During the summer all 58 supply units are utilized to supply ventilation, and have a total of 3,480,000 cfm delivery. When the outdoor temperature exceeds the indoor temperature, the units along the outside walls are shut down, and the corridor units are run on recirculated air.

We have found as much as a 7 F difference in temperature of the air entering at one side of the building than at another, so the operators are trained to check the

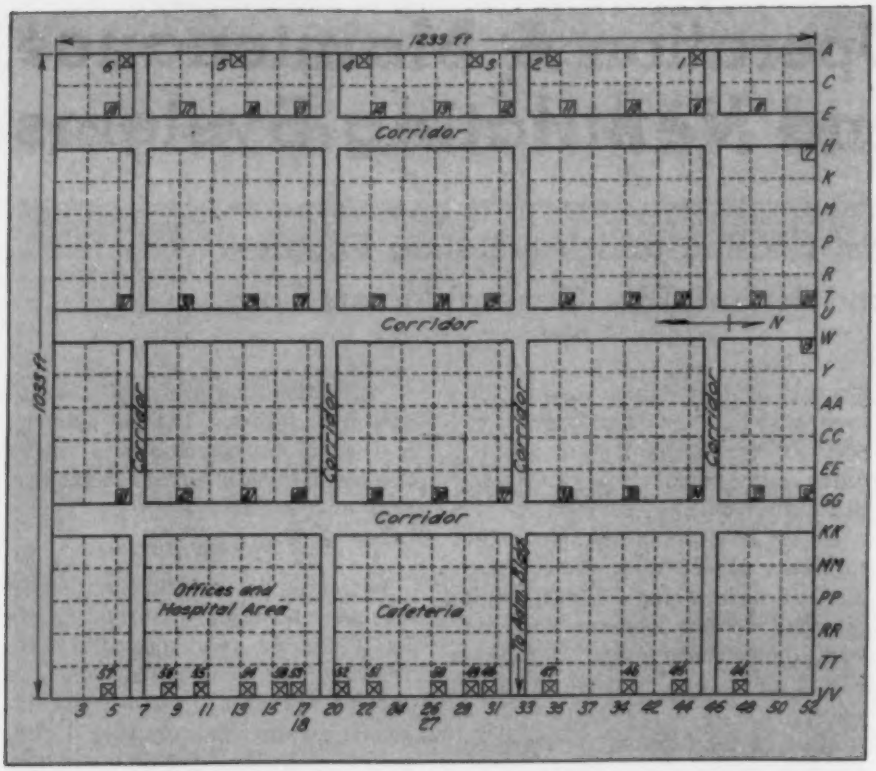


Fig. 1—Layout in the basement of the main assembly plant. The heating and ventilating equipment is numbered 1 through 58, and those units marked with an "X" located in heater rooms along the east and west walls are the chief source of outside air. There are two oil fired heaters attached to each plenum chamber

incoming air temperatures closely, and to shut off the units bringing in air at a higher temperature than the inside spot location temperatures for the area that particular unit serves.

As previously mentioned, most all of the exhaust fans are located on the roof, except those for the washrooms and special production operations.

Last summer 32 of the roof fans located over the balcony were reversed to pump air into the building and the results were surprisingly satisfactory. The inlet of these fans is about 40 in. above the roof level with a "mushroom" type cover over the fan blades. We found that, at this level, the temperature of the air entering the fan was several degrees lower during the day than the air which was being drawn into the building from the air wells at ground level. The roof temperature had practically no effect on the incoming air. Attached to the ceiling beneath each of these exhaust fans we installed a cone shaped diffuser in order to disperse the air over a larger area, and to reduce drafts on the employees.

Fig. 6 shows spot location temperatures as compared to outdoor temperatures for a few days in June of last year.

Handling Employee Complaints

During the summer of 1943, when the plant was being put into operation, the employees gathered the impression—probably from the maze of ductwork—that the plant was air conditioned and they expected conditioned air to flow from the registers. These new employees were coming from all walks of life, and it was the first time most of them had been in a blackout type of building.

Invariably a complaint of "too hot" would show (when checked) the ambient temperature in which the employee worked to be as much as 10 to 12 deg cooler than outside temperature. A common reply from the complaining employee was that he "didn't realize how hot it was outside because he could not look out."

A study of the summary of ventilating complaints for June reveals 21 complaints in the main assembly plant—the blackout building—for each one complaint received from the administration

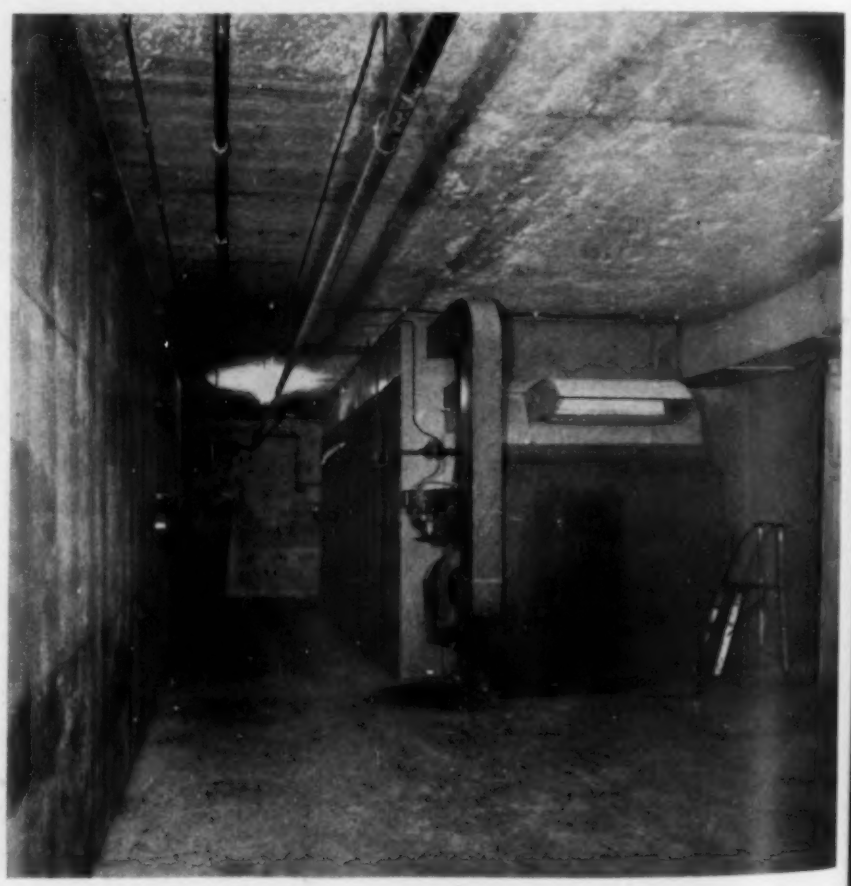


Fig. 2—An outside heater room with two oil fired heaters attached to plenum chamber; each heater has an 850,000 Btu output. The door on the right is where air is drawn into the heater room from an air well

Fig. 4—Exhaust fans on the roof. The small penthouse on the expansion joint contains the wet and dry bulbs for the recorder located in the heating and ventilating department office

building—not a blackout building—even though the temperatures in the administration building averaged 4 to 5 deg warmer. The ratio of employees engaged in the buildings is about three to one.

During the early part of last summer, one session was held by the executive development conference leaders to explain to all supervision the operation of the ventilating system, its limitations, and to show the equipment in operation. Of course, all supervisors were not sold on the idea that the heating and ventilating personnel were doing everything possible to make them and their employees comfortable; but the majority of the supervisors did take away from the classroom some ideas, and they were able to handle many of their employee complaints. The only complaints accepted are those from the supervisors, and when a supervisor is unable to satisfy his employee or he feels there is need of improvement in the ventilation system in his area, he can register a complaint to the heating and ventilating department.

The information given to the supervisors on the operation of the system and its limitations assisted materially in reducing the number of complaints in 1944 and 1945 as compared to those in 1943.

Fig. 3—A corridor unit with a single oil fired heater attached to plenum chamber. This heater has a 750,000 Btu output

Personnel to Operate System

Each shift is supervised by a foreman, who has five operators to control the operation of the heating and ventilating equipment and two men for service and repair work.

There is one licensed boiler operator for the administration building and a nearby processing boiler. There are three operators, one of whom must be a licensed boiler operator in the main assembly plant, and one operator for the hangar, flight building, and miscellaneous buildings. However, the latter operations are dispensed with at the end of the heating season, and these few duties are taken over by one of the other operators.

The duties of the operators are to check the performance of the equipment in their areas, to check

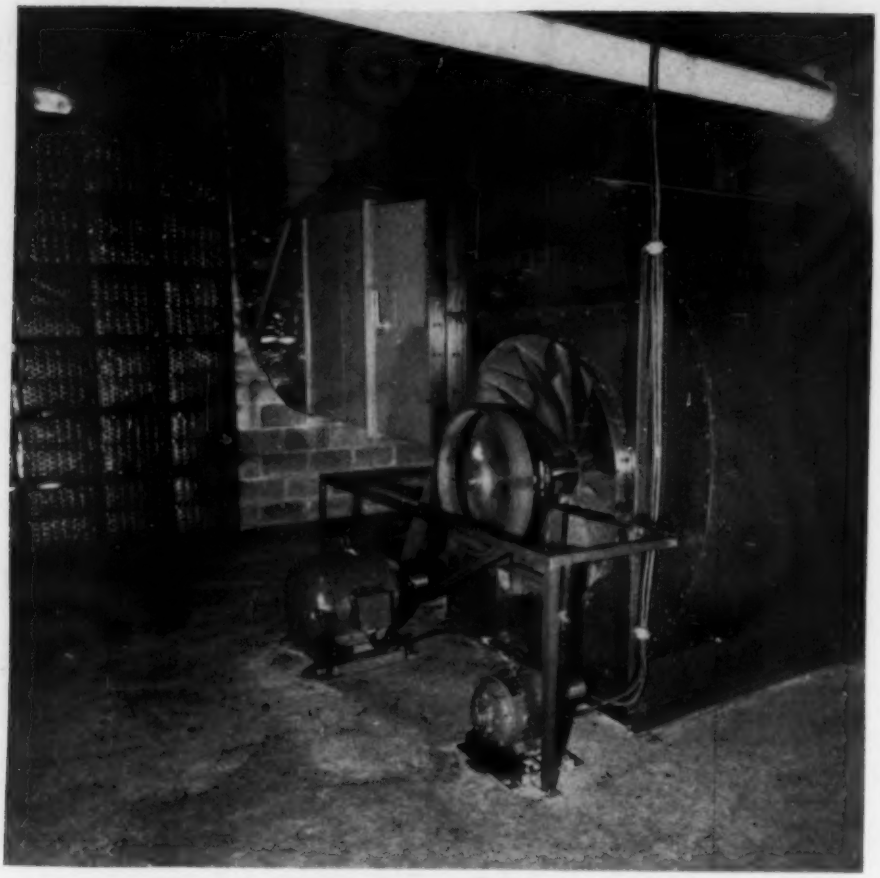


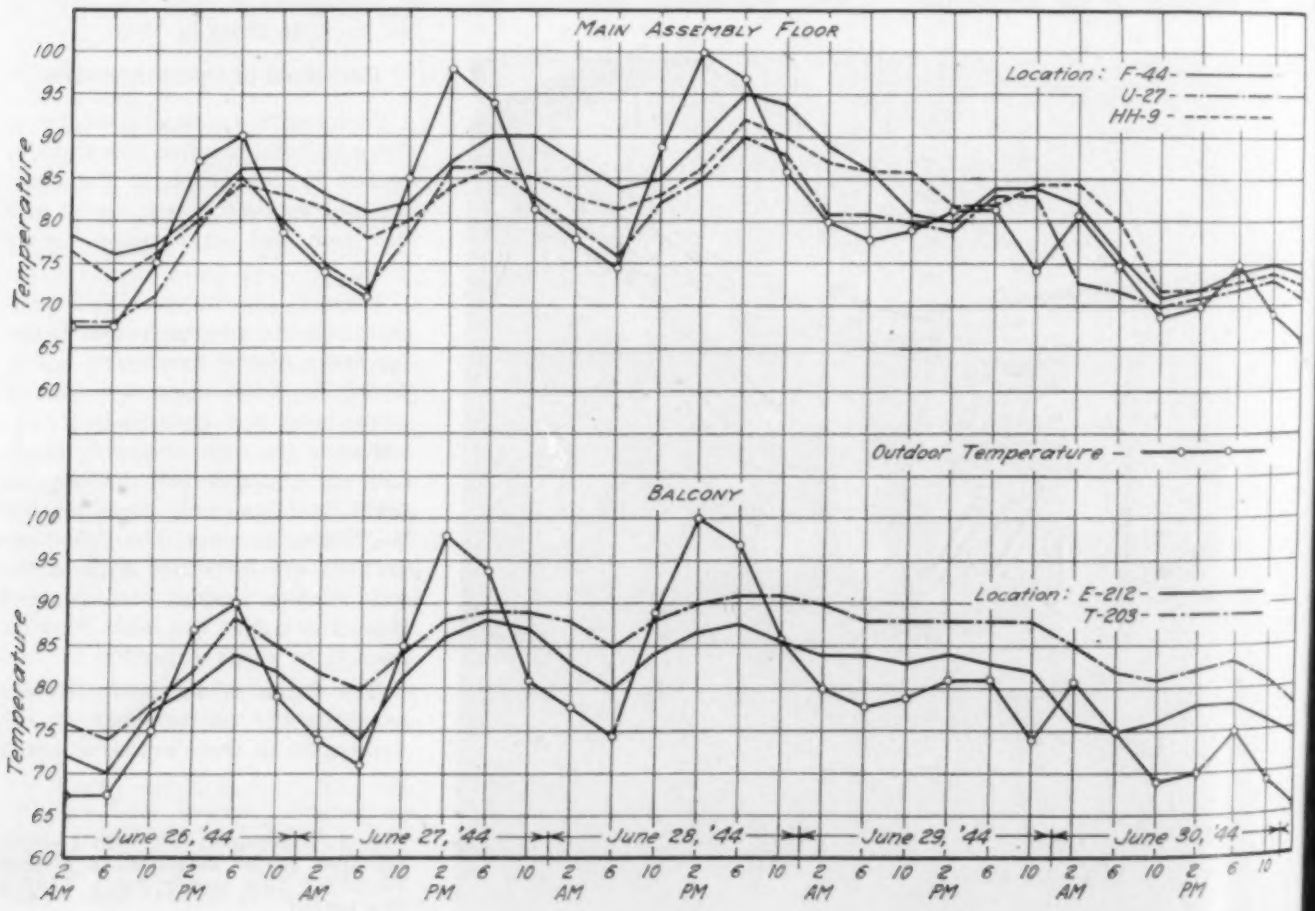
Fig. 5 (above)—View of the plenum chamber inside showing the two-motor arrangement for winter and summer operation

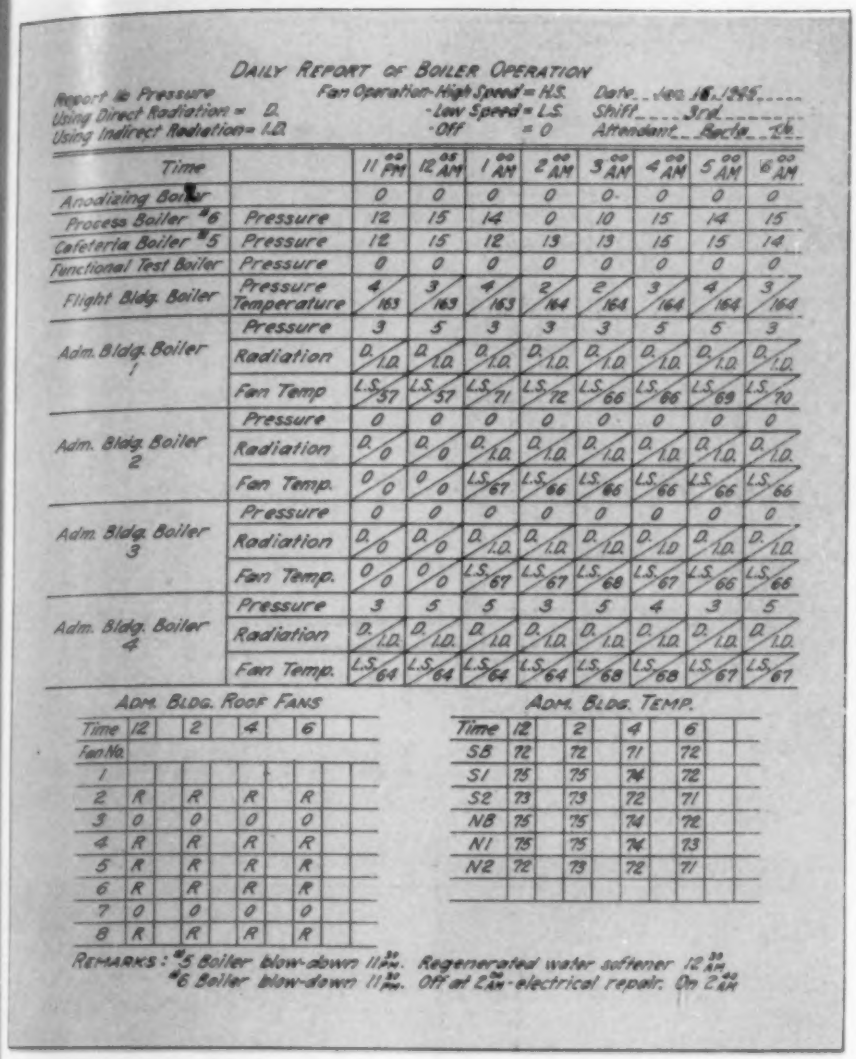
all air temperatures in the supply units, and to make routine checks of spot location temperatures. They also make minor adjustments to the equipment when it does not interfere with their scheduled routine work. Figs. 7 and 8 are typical of the log sheets showing routine checks made on the performance of the heating and ventilating equipment.

At the end of each shift, the foreman reviews the log sheets and makes out a regular "mechanical trouble call" form for work to be done by the following shift. The spot location temperatures are logged, and a graph is prepared showing these temperatures in comparison to outdoor temperatures. This graph shows nine temperature readings on the first floor and seven on the balcony.

All complaints of "too hot", "too cold", "too drafty", etc., are written up on a "squawk sheet" (Fig. 9) and handled by the operator for that area. The operator investi-

Fig. 6 (below)—Spot location temperatures in the main assembly plant for a few days last summer





DAILY REPORT OF BOILER OPERATION

Report to Pressure — Fan Operation-High Speed = H.S. — Date Dec. 16, 1945
Using Direct Radiation = D. — Low Speed = L.S. — Shift 3rd
Using Indirect Radiation = I.D. — Off = 0 — Attendant Backs

Time		11 00 PM	12 05 AM	1 00 AM	2 00 AM	3 00 AM	4 00 AM	5 00 AM	6 00 AM
Anodizing Boiler		0	0	0	0	0	0	0	0
Process Boiler #6	Pressure	12	15	14	0	10	15	14	15
Cafeteria Boiler #5	Pressure	12	15	12	13	13	15	15	14
Functional Test Boiler	Pressure	0	0	0	0	0	0	0	0
Flight Bldg. Boiler	Pressure	4	3	4	2	2	3	4	3
	Temperature	163	163	163	164	164	164	164	164
Adm. Bldg. Boiler 1	Pressure	3	5	3	3	3	5	5	3
	Radiation	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.
	Fan Temp	L.S. 57	L.S. 57	L.S. 71	L.S. 72	L.S. 66	L.S. 66	L.S. 69	L.S. 70
Adm. Bldg. Boiler 2	Pressure	0	0	0	0	0	0	0	0
	Radiation	D. 0	D. 0	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.
	Fan Temp.	0 0	0 0	L.S. 67	L.S. 66	L.S. 66	L.S. 66	L.S. 66	L.S. 66
Adm. Bldg. Boiler 3	Pressure	0	0	0	0	0	0	0	0
	Radiation	D. 0	D. 0	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.
	Fan Temp.	0 0	0 0	L.S. 67	L.S. 67	L.S. 68	L.S. 67	L.S. 66	L.S. 66
Adm. Bldg. Boiler 4	Pressure	3	5	5	3	5	4	3	5
	Radiation	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.	D. 1.0.
	Fan Temp.	L.S. 64	L.S. 64	L.S. 64	L.S. 64	L.S. 68	L.S. 68	L.S. 67	L.S. 67

ADM. BLDG. ROOF FANS

Time	12		2		4		6		
Fan No.									
1									
2	R		R		R		R		
3	0		0		0		0		
4	R		R		R		R		
5	R		R		R		R		
6	R		R		R		R		
7	0		0		0		0		
8	R		R		R		R		

ADM. BLDG. TEMP.

Time	12		2		4		6		
SB	72		72		71		72		
S1	75		75		74		72		
S2	73		73		72		71		
NB	75		75		74		72		
N1	75		75		74		73		
N2	72		73		72		71		

REMARKS: #5 Boiler blow-down 11 30 PM. Regenerated water softener 12 30 AM
#6 Boiler blow-down 11 30 PM. Off at 2 AM - electrical repair. On 2 30 AM

Fig. 7—A typical log used for check of all boiler operations and spot location temperatures in the administration building.

Table 1—Summary of heating and ventilating complaints, June 1944

Location	Justified Complaints	Time Spent In Hours	Unjustified Complaints	Time Spent In Hours
Administration building				
1st shift	3	1.0	0	0
2nd shift	1	0.3	0	0
3rd shift	1	0.3	0	0
Manufacturing building				
1st shift	44	18.0	14	5.3
2nd shift	19	5.8	3	1.0
3rd shift	21	4.6	3	1.0
Hangar building				
1st shift	0	0	0	0
2nd shift	1	0.3	0	0
3rd shift	2	0.6	0	0
Totals	92	30.9	20	7.3

Table 2—Summary of heating and ventilating complaints, January 1945

Location	Justified Complaints	Time Spent In Hours	Unjustified Complaints	Time Spent In Hours
Administration building				
1st shift	13	3.3	3	0.8
2nd shift	7	1.3	0	0
3rd shift	0	0	0	0
Manufacturing building				
1st shift	28	9.8	3	0.8
2nd shift	8	2.5	1	0.3
3rd shift	0	0	0	0
Hangar building				
1st shift	0	0	0	0
2nd shift	0	0	1	0.3
3rd shift	0	0	0	0
Miscellaneous buildings				
1st shift	0	0	0	0
2nd shift	1	0.5	0	0
3rd shift	0	0	0	0
Totals	53	17.4	8	2.2

gates the complaint, and if it is "justified", he makes adjustments to remedy the complaint. If the complaint is "unjustified", he explains to the supervisor registering the complaint what the temperature is, the air movement, etc., and then the proper notations are made on the "squawk sheet". These sheets are cataloged in the office and a monthly report compiled from them.

The operators must be tactful in handling the complaints—especially the "unjustified" ones—and truthful in reporting to the supervisor on the conditions. We have found it very helpful to set a temperature recorder in an area where there is a chronic complaint of temperature, and to use a direct reading air velocity meter or an anemometer to show the complainant just how much the air movement is. Suffice it to say that most of the operators have learned a lot about the psychology of people and how to deal with them!

The two mechanics on each shift service and repair the oil fired heaters and the ventilating equipment, and take weekly orsat tests for combustion efficiency.

In the office of the heating and ventilating department is a blackboard on which is posted the hourly temperatures, the wind direction and—twice each day—the Weather Bureau forecast. The postings are made on this bulletin board to assist the operators but they have attracted the attention of many other employees in the plant who stop by to read the forecast and the outdoor temperature.

I believe that, in a blackout type of building, it would be an aid to operation to announce over the public address system the weather conditions once or twice during each shift.

Oil Consumption

The fuel oil estimate was figured at 1,286,800 gal for heating purposes only, and from our summarized oil report, it is found that 856,768 gal of oil was consumed for heating during the year 1944. This

Section: Center
Operator:
1st Shift _____
2nd Shift D. Nelson 1st
3rd Shift E. Herronen 1st

Daily Maintenance & Inspection of Heating & Ventilation Equipment

Date 1-15-45

Time	11 PM	2 AM	6 AM	7 AM	10 AM	2 PM	3 PM	6 PM	10 PM
Flame Adjustment	✓	✓	✓	✓	✓	✓	#20 A	✓	✓
Iris Eye	✓	✓	✓	✓	✓	#25 A	✓	✓	✓
Thermostat Setting Against Area Temp.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air Pressure	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air Filters	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mag. Oil Valve	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lube Oil Level	✓	✓	✓	✓	✓	✓	✓	✓	#49 A
Fuel Oil Line Pressure & Leaks	✓	✓	✓	✓	✓	✓	✓	#52 A	✓
Modulating Motor	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ignition	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ignition Points	✓	✓	✓	✓	#7 BR	✓	✓	✓	✓
Heater Fan Shaft & Bearing	✓	✓	✓	✓	✓	✓	✓	✓	✓
Supply Fan Shaft & Bearing	✓	✓	✓	✓	✓	✓	✓	✓	✓
Belt Alignment	✓	✓	✓	#20 L	✓	✓	✓	✓	✓
Housekeeping	✓	✓	✓	✓	✓	✓	✓	✓	✓

Inspection Symbols

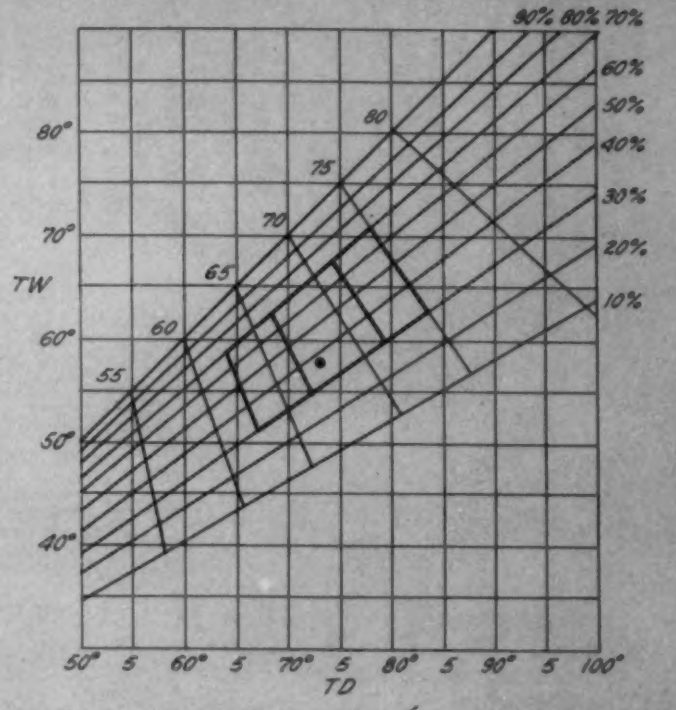
O-Repair Report — BT-Bent — W-Wrong — L-Loose — A-Attention
BR-Burnt — AJ-Adjust — T-Tight — D-Dirty — TN-Tension
G-Good — ✓-OK — F-Fair — B-Broken — C-Change

Remarks: Lights out - HR #23 - #25 - #31 - #33
Roof Fan V35K Switch not working

Fig. 8—A typical log covering one day's check on the heating and ventilating equipment. A modified sheet similar to this is used for summer operation

Squawk Sheet

Date 1-15-45 — Complaint Cold
Time Called In 1:30 P.M. — Location TL 35
Time Completed 1:45 P.M. — Name E. King



Justified _____ Unjustified ✓ Time Spent 15 min

Remarks: TD-75° — Explained temperature - now satisfied.
TW-58°

Operator E. B. Watkins

Fig. 9—Any complaint registered by a supervisor is written up on the "squawk sheet." The wet and dry bulb temperatures are plotted on the ASHVE comfort chart. If these temperatures fall within the comfort zone, and air velocity is under 25 fpm, the complaint is checked as "unjustified"

is an average of 140 gal of oil per degree day for heating a total of 2¾ million sq ft of floor space.

Twice each shift an oil reading is taken at the pump house; at the end of the day the daily oil consumption report is made up, and the oil used for heating is plotted on a graph showing the degree days. This graph is posted where all employees can see just how much oil is consumed per degree day. This plan stimulates interest to save fuel oil by keeping the oil burners in efficient operating condition and economically operating the system as a whole.

Filter Maintenance

There are 4435 filter openings in the entire ventilating system, and four 1 in. filters are used in these openings, making a total of 17,740 filters, most of which are of the throwaway type. Once a week a draft gage reading is taken on each filter bank. During the summer, when the blower is handling 60,000 cfm, and the draft gage shows 0.5 in. resistance, the filter is cleaned once, and the second time it registers 0.5 resistance, the filter is replaced by putting a new filter to the inside of the plenum chamber and moving the other three filters progressively toward the outside.

During the heating season, when the blower handles 25,000 cfm, the above procedure of cleaning and replacing filters is done when the draft gage reading shows 0.15 in. resistance.

Pipe Line Engineers Build Submerged Line

The high degree of success achieved by a petroleum distribution company in the Pacific has resulted in a new method of laying submerged pipe line. The method is being recommended to engineer petroleum distribution units all over the Pacific, says the War Department.

The problem which one EPD company, at an advanced base, faced was to bridge a mile wide gap between an offshore tanker anchorage and empty gasoline storage tanks on shore. The regular methods of building a timber pile supported hose deck wouldn't work because there was too much mud. Some other means had to be improvised to permit ocean going tankers to discharge their cargoes of motor fuels directly to the shore storage and distributing pipe line system.

A hydrographic survey showed that the ocean floor sloped gently from the sand beach to almost level mud bottom 30 to 35 ft below tide level at a distance of 4600 ft from the shore. The engineers decided to construct a submerged pipe line of 8 in. welded steel line pipe.

The first obstacle was 600 ft of wet swampy land between the beach and the nearest road. Using tractors and scrapers to haul beach sand, the EPD company built a combined assembly and launching area 600 ft long by 40 ft wide. On this foundation, timber stringers were laid to support sections of pipe placed at 15 ft centers to serve as supports during assembly and as skids for launching.

Eight inch steel line pipe was assembled into 600 ft sections on the ramp, and the sections joined by electric arc welding. When 4800 ft of pipe had been welded into 600 ft sections a bridle of heavy chain was welded into the seaward end of the first section for towing and for attaching a marker buoy. A timber "sled" was framed around the seaward end of the pipe and the line was ready for launching.

The toughest problem of all was solved with the help of the Navy. A net tender with a winch provided motive power for the launching. Two 12 ft triangular range markers were erected on shore to guide the tender; in addition, blinker light signal communication was maintained between ship and shore.

When all was ready, the ship was anchored on range. The winch line was run ashore and attached to the towing bridle. The first 600 ft section of pipe was winched out until its shore end came opposite the sea end of the second section. The two sections were aligned with the aid of a winch equipped 2½ ton truck and joined by two welders working simultaneously to speed the operation.

This procedure was repeated until the required 4600 ft of pipe was launched and floating just beneath the surface. During launching, marker buoys, improvised from large diameter pipe sections, were fixed to the line at 1200 ft intervals to mark its course.

When the line was fully launched the "sled" at the seaward end was loaded with concrete blocks to sink and anchor it. While a tractor held a slight strain on the pipe to maintain alignment, water was pumped into the pipe to sink the line and the job was done. The total elapsed working time was 8 hr, 25 min.

WHAT DOES THIS MEAN?

This insigne stands for honorable service to our country; it is awarded to veterans of the present war

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"H.M.S. CONUNDRUMS"

You can't beat the British when it comes to naming naval vessels. In "Operation Pluto"—meaning "pipe line under the ocean"—70 miles of pipe were wound around huge floating drums (see page 330 of the June HPAC) for laying in the English Channel. And, inasmuch as the project was very much of a secret before the invasion of Europe, the drums were called "H.M.S. Conundrums."

HEATING GLENN L. MARTIN CO. HOUSING

By Jan Porel, Assistant to the President
The Glenn L. Martin Co.

A THOROUGH study of the prefabricated housing field was made in 1939 when the Glenn L. Martin Co. first started construction of a housing project near their plants in Middle River, Md. For months, company officials and engineers, in conjunction with representatives of the Pierce Foundation, studied what was available on the market. Utilizing the knowledge they gained in this manner, and incorporating such developments they had derived from their own "guinea pig" experiments, the group planned their low cost, economical structures which have been adapted throughout many housing areas.

Because the plants were growing by leaps and bounds and the nearest living facilities were outside a 12 mile radius of Baltimore, the houses, of ample living space, were built in the shortest possible time. Peak production found 350 employees turning out 16 houses per day.

The houses are composed of a large living room with a dining alcove, a modern kitchen equipped with electric refrigeration and cooking facilities, a 30 gal water heater, etc. All water lines are copper. The units have two bedrooms, storage space, and ample closets. The exterior walls and partitions are constructed of single thickness insulation panels on wood frames. The floors are wood, and the roof is patented insulation shingle. Exterior and interior panel surfaces are left natural.

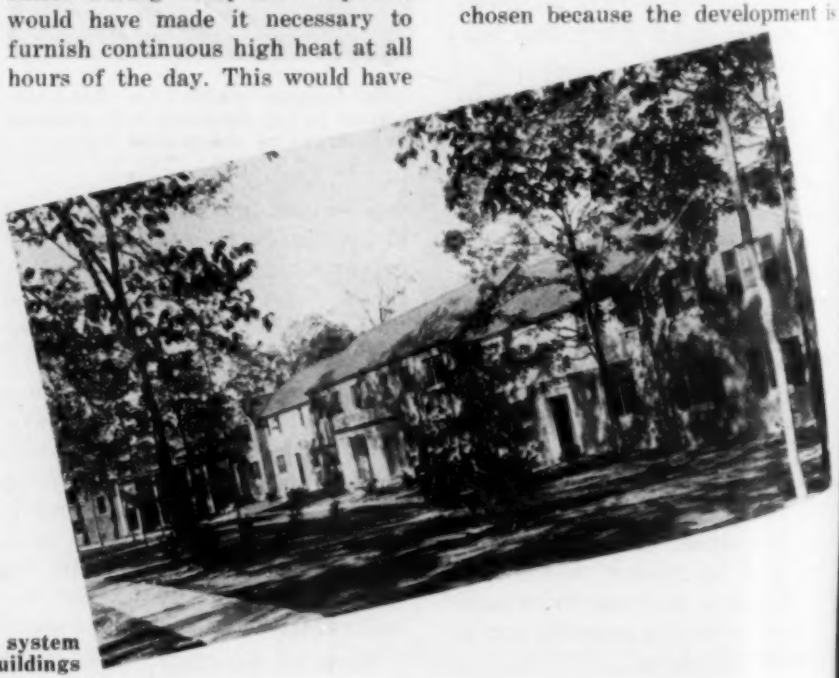
Because of the long heating period each year in the Baltimore area, which averages annually slightly over six months, keeping the homes comfortable presented somewhat of a problem. Heating is accomplished by means of a 50,000 Btu gravity floor furnace, using No. 1 oil fuel. The 110 gal fuel storage tanks are located inconspicuously at the rear of the structures. The flue is a porcelain enamel pipe.

INDIVIDUAL prefabricated houses heated by 50,000 Btu gravity floor furnaces, using No. 1 oil. Apartment type dwellings served by central steam plant with stoker fired boilers. Operation and maintenance of the heating systems carried on by the housing corporation management, the staff consisting of an engineer and 14 men.

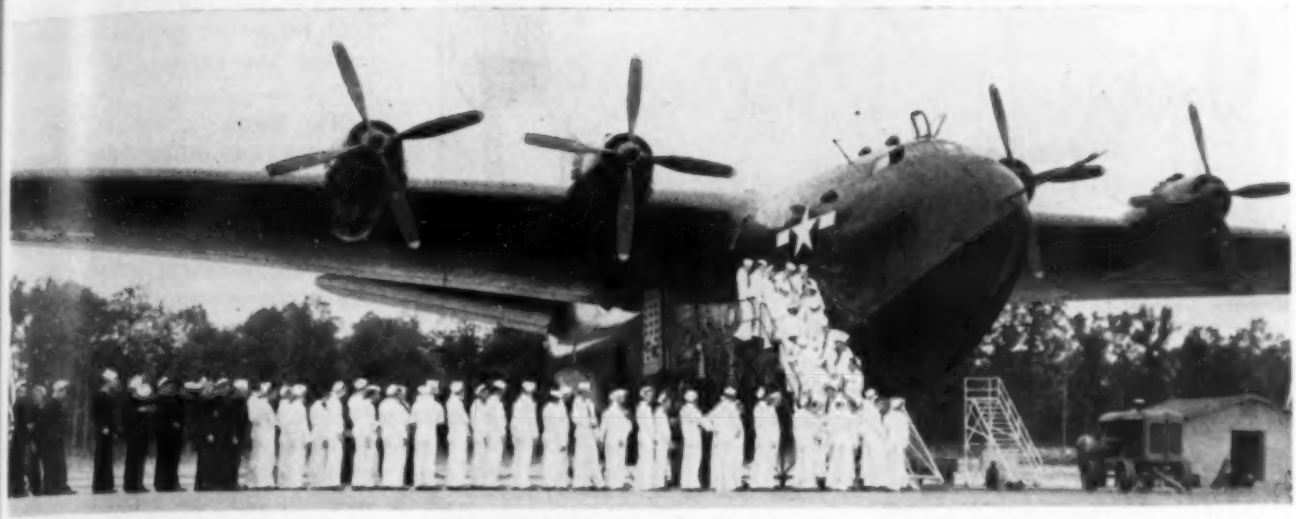
Individual heating furnaces were installed in the small houses because low cost rental rates and the physical characteristics of the development made any type of central heating system entirely out of the question, in the company's opinion. The fact that occupants of the various houses work on three different shifts during every 24 hr period would have made it necessary to furnish continuous high heat at all hours of the day. This would have been costly with the central system method, it is believed. Too, the building group foresaw the possible shortage of heavy fuel oils and coal and felt that kerosene and No. 1 fuel had a better chance of being supplied in case of an emergency.

In addition to the individual family dwellings, apartment type residence dwellings also were built by the company in the same areas. These are of brick construction with stone and wood trim. A total of 26 buildings, including the commercial center, comprise this group. The commercial facilities include stores, an air conditioned theater with a seating capacity of 600, and a large community building which houses a restaurant, bowling alleys, and various offices. The brick apartment buildings are heated by a low pressure steam system. Temperatures are regulated by manual control in each apartment, and the heat mains are in concrete trenches. Originally, the heating boilers in this system were oil fired, but with wartime fuel shortages they were satisfactorily converted to stoker firing.

The commercial center is heated by the same system as the apartments. A central heating plant was chosen because the development is



A central plant steam system heats the apartment type buildings



On an inspection tour, 108 officers and men from the naval training school at the Glenn L. Martin plants in Baltimore file into the "Hawaii Mars. This is the plane that cracked up and sank in Chesapeake Bay August 5.

located in an area near the Martin company's airport and all types of stacks were restricted to a height of 45 ft. The number of stacks also had to be kept at a minimum.

The two 150 hp steel boilers are centrally located in a boiler house which was originally constructed to accommodate three boilers. Plans to enlarge the area and install the third boiler were curtailed during the war. The stack is a forced draft venturi steel type, mounted on masonry. The central plant has resulted in economy of operation, fuel delivery convenience, and better appearance. It also allowed for road construction to be kept at a minimum and as much of the "park" atmosphere as possible to be retained because of the elimination of individual fuel delivery to each apartment building.

All operation and maintenance of the system is carried on by the housing corporation management. They maintain their own unloading fuel yard on a siding where storage is available for approximately 1500 tons of Pocahontas coal. This coal is delivered during the summer season. Loading devices are kept at the yard and one truck is used to move the coal to the boiler house. The coal is dumped into hoppers which feed by gravity into the stokers. The entire maintenance staff consists of one engineer and 14 men, including the truck driver.

Oil fuel for the individual homes is delivered under contract with several oil companies, subject to the control of the OPA regulations.

The air conditioning system installed in the theater is a 50 ton unit supplying refrigerated air through a simple overhead duct system to the auditorium. The return is a simple duct system with grilles in the bulkhead of the stage only. Temperature controls are automatic or manual selective. This system has proved highly satisfactory and economical.

In an effort to make living conditions as pleasant as possible for the tenants, the building officials selected a heavily wooded, waterfront location which makes fishing, boating, and swimming facilities of the Chesapeake Bay and tributary rivers readily accessible. Providing both individual and group types of homes allows accommodations for both large and small families, as well as giving the tenants a choice as to which type of dwelling they prefer. There is space provided for those who wish to cultivate victory gardens.

Best proof that the Martin company has succeeded in their efforts is that many other groups have studied these homes in an effort to solve their own housing problems. The renting department has long lists of applicants wanting accommodations.

BLOWERS WILL "DEDUST" PEOPLE ENTERING BUILDING

Construction of a new $500,000 windowless ampul building for the Winthrop Chemical Co., Inc., featuring blowers in the entrance lobby for the "dedusting" of all employees and visitors, is under way at Rensselaer, N. Y., according to Dr. Theodore K. Klumpp, president.

Those entering the building will pass single file in front of the blowers which will remove dust, dirt, and lint from their clothing. Similar units will be located at other inside control points. This feature is part of the overall plans of the building, designed by engineers of the Austin Co., "with a view to a more complete elimination of germs, dirt, dust and atmospheric variations than has ever before been attempted in a pharmaceutical laboratory."

Light for the windowless building will be provided by horizontal panels of glass brick. The interior will be subdivided into individual contaminationproof departments. Interdepartmental visibility on each floor will be assured by glass panels.

Ultraviolet lamps are to be installed in the air conditioning ducts leading to all production departments to insure the delivery of germproof air. Glazed tile walls and double glazed partitions, designed without moldings or ledges; a suspended ceiling with recessed fluorescent lighting fixtures; and concealed piping and mechanical equipment will expedite the maintenance of dustfree conditions at all times, according to the engineers.

"Open for Discussion"

MAINTENANCE SCHEDULE FOR HEATING PLANTS

THE EDITOR—The article by L. W. Mauger in the July HPAC on maintenance and repair of heating plants is a long step toward filling a definite need for clear, concise information on the care of boilers and other heating equipment.

The boiler, the heart and source of the comfort and power of any heated structure, is also the equipment which—through ignorance or neglect—is often improperly serviced or forgotten entirely until trouble develops.

We have found that boilers which are properly serviced from year to year not only have a much longer period of useful life free from repairs, but also are capable of operating at a higher degree of efficiency than boilers which are not so serviced.

Mr. Mauger in his article clarifies the picture of protective boiler maintenance, but we believe that maintenance of boilers can be clarified even more if the maintenance superintendent would be provided with a "check list" of the various steps involved in placing equipment in condition for the following season.

The proper procedure should be provided for in a descriptive manual by every manufacturer.—HOMER ADDAMS, president, Fitzgibbons Boiler Co., Inc.

VENTILATION OF FINISHING TANKS

THE EDITOR—The article by Allen D. Brandt in the May HPAC, on the subject of Ventilation of Finishing Tanks, is timely and will prove of considerable value to the air conditioning engineer. It seems to me that the science and art of moving air have been pretty much neglected in the past and that the approach has been more one of "empirical data" or of "customary practice." The designer of an air handling system, whether it be for human comfort or for process, must take his engineering seriously, and this article of Dr. Brandt's will help on the particular problems discussed.

One point that Dr. Brandt makes should be emphasized every time anybody writes anything or says anything about handling air and that is the source of supply for the exhaust system. In simple words, "Where does the air come from?"

The designing engineer will find it will pay to study the direction and velocity of supply air in order to insure the successful operation of an exhaust system. The push-pull principle is of the essence.—LESTER T. AVERY, president, Avery Engineering Co.

FACTORY AIR CONDITIONING

THE EDITOR—Permit me to extend my congratulations for the most excellent article contained in your June issue. The article—When Is Complete Air Conditioning of the Modern Factory Advisable?, as prepared by H. A. Mosher—is without a question one of the most complete compilations of the analytical reasoning required in determining the answer to this question.

Mr. Mosher's article does not presume to go into a detailed analysis and the requirements of each and everyone of the great variety of present day industrial processes. He does, however, set forth very clearly the economic justification of complete air conditioning wherever the specific process is adversely affected by the air temperature and/or relative humidity changes or by the cleanliness of the air supplied; for the purpose of ventilation; or for the control of some fixed temperature and humidity condition, commensurate with the specific processing requirement.

Air motion within a factory is, of course, as important and as necessary with a complete air conditioning system as it is with an ideally designed ventilation system. In most cases, however, as pointed out, it will be found that the air volumes required to produce a uniform temperature and humidity condition will be considerably less with a complete air conditioning system than with an ideally designed ventilation system supplying air for ventilation only.

The pertinent economic factors involved have been exceptionally well covered and summarized by the author in his article.

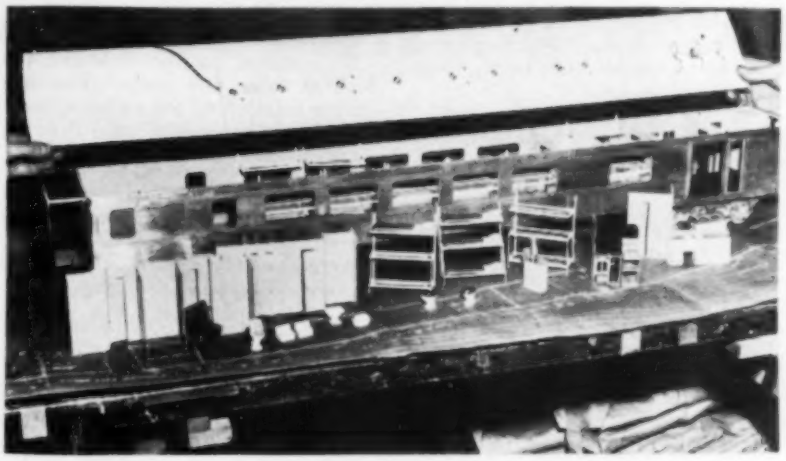
The end results of many industrial processes are directly and adversely affected only by temperature changes, others only by variation of the relative humidity during the processing cycle, there are some processes that are adversely affected by either or both temperature or relative humidity changes, and some for which the control of a predetermined absolute humidity (dew point) is of prime importance, yet unaffected by either the dry bulb temperature or relative humidity directly. Any of these prerequisite conditions for the process, obviously, should suggest the economic importance and the use of a complete system for controlled air conditioning.—E. P. HECKEL, E. P. Heckel & Associates, consulting engineers; member of HPAC's board of consulting and contributing editors.

THE EDITOR—Your lead article in

WHEN ENGINEERS gather to hear a paper or talk, there comes a time when the meeting is thrown "open for discussion." We follow this custom in these columns, which provide an opportunity for readers to comment on and discuss articles published in HPAC as well as other topics of interest to heating, piping, and air conditioning engineers and contractors. The editors will welcome your remarks. Address Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2

the June issue, When Is Complete Air Conditioning of the Modern Factory Advisable?, by H. A. Mosher, is an absorbing report. Mr. Mosher is to be complimented upon the clarity with which he reaches his conclusions, and for a piece of generally admirable engineering journalism.

I refrain from calling his conclusions "startling" because they verify much that I have observed in my own experience. Doubtless many engineers have found that even moderate success at comfort cooling with outdoor air supply systems has, in many instances, proved inordinately expensive for the area so treated. Mr. Mosher's correlation of costs of industrial comfort cooling by this method and by air conditioning, should prove a useful reference to the profession. It is to be hoped that others will supplement the data he presents with similar cost studies.—JAMES N. LIVERMORE, construction engineering, The Detroit Edison Co.



MODEL OF AIR CONDITIONED HOSPITAL CAR

This model of a hospital unit car, an exact replica of 200 ordered by the War Department from American Car and Foundry Co., is built exactly to scale in the proportion of ½ in. to the foot. Materials used in its construction are principally of brass. Each rivet on the exterior of the original car is reproduced in exact detail on the model. The hinged roof is carved from a laminated block of mahogany. Lighting and concealed wiring are identical with the original model; even to the tiny electric bulbs, one-half the size of the tiniest flashlight bulb, reproducing the well-lighted interior of the cars.

The interior of the model faithfully reproduces all of the modern facilities of the original car; the kitchen with its stove, oven, sink and faucets in dolls'-house size; the receiving room; main section with the three-tiered bunks, even to mattress, pillow and blankets are made up ready for use. Doctor's and nurse's sections are unique in their arrangement; bathroom fixtures and units were all put in place after the model was assembled. Lettering on the car is an exact reproduction of the Army medical corps requirements. The model was built by Boucher, skilled in the building of ships' models, aircraft and other equipment.

Hospital cars of this type are air conditioned by an ice-activated system.

FIGURING SEASONAL COST OF HEATING A BUILDING

THE EDITOR—We certainly appreciate the opportunity of examining Samuel R. Lewis' remarks (published in the June, HPAC) on our material concerning building heat requirements. Mr. Lewis apparently overlooked some of the explanations in our paper and misunderstood some others. The following comments explain in sequence the portions of his comments that we believe particularly should be corrected:

1) *Mr. Lewis stated that we did not disclose how we determined that the seasonal heat loss due to infiltration is only 6.2 per cent of the total, while computation by the Guide method shows 18.5 per cent.*

We explained in our study that "about one-third of the design infiltration loss remains unincluded in the ventilation loss." Detailed calculations were not listed showing how about two-thirds of the design infiltration loss is included in the ventilation loss. This is based upon the condition that average wind velocity during the daytime while the ventilating fans are operating is about three times the average at night while they are not operating. Movement of the same air through the building should not be figured twice regardless of whether it enters due to a combination of pressure and suction or merely by comparatively low pressure, as at night.

2) *Mr. Lewis stated that he did not accept the limits of 5 and 35 per cent as applying to the infiltration portion of seasonal heat loss for most buildings. He said further that he did not think we meant to accept this statement.*

The best answers to this are Mr. Lewis' comments that "In practice, for average design purposes, we seem to get along pretty well if we allow for infiltration by adding 30 per cent to the design transmission loss of all exposed glass and walls." Also, "average rather than maximum rates of heat loss must determine the seasonal total."

Average seasonal infiltration loss is proportional to average wind velocity and average wind velocity is always less than that used for design purposes, about 40 to 50 per cent less in most cities. Using 50 per cent of the 30 per cent that Mr. Lewis allows for design purposes we have 15 per cent for total seasonal infiltration loss. This is within the lower one-third of the 5 to 35 per cent range we suggested.

3) *Mr. Lewis stated that "it is definitely impracticable to compute accurately the cost of fuel for any ventilated building unless the hours during which the ventilating equipment is operated at a definite rate are known, etc."*

Our reply to this is that the relative accuracy of any other of the many factors affecting fuel consumption depends upon the amount and accuracy of the obtainable data. Data regarding the ventilating system operating schedule frequently is more easily obtained than other data because it depends mainly upon the occupancy schedule.

4) *Mr. Lewis indicates that values for such factors as heat gain from the sun and lights are capable of wide variation and are undependable for use in computing the design heating capacity.*

The fact that such factors are subject to wide variation should be sufficient reason for considering them whenever applicable. We of course mentioned that more data are needed regarding the effect of the sun. We disagree that data regarding heat from lights or other electrical equipment are undependable. Metering of electrical energy used in buildings has

reached a comparatively high degree of accuracy.

5) *Mr. Lewis stated that our conclusions for the Mutual building were apparently worked backward from the actual meter rate.*

We did not expect to avoid this comment because we were asked to submit a comparison of calculated and metered consumption. All we can say is that the only information used was obtained from the Mutual building construction plans, the building engineer, and the 1944 Guide. If the building engineer had not kept close check on the heating and ventilating schedule, we would have been forced to do some measuring. The same dimensions and factors would have been used regardless of steam metering data.

6) *Mr. Lewis said that our tabulation indicating that the fuel cost must be increased if electric heat and power are consumed is confusing.*

As we explained in our analysis, the degree day base of 65 F is based on the condition that all heat required to maintain a building above 65 F is supplied by sources of heat other than the heating system (by definition and by use). It so happens in the case of the Mutual building that heat gain from electricity was less than the standard rate of heat gain. This arbitrarily assumed standard rate should be the one which, together with standard occupancy, makes the 65 F base accurate. This situation apparently is seldom considered because the 65 F base has not yet been defined completely.

If the total heat supplied a building by sources other than the heating system is not sufficient to maintain temperatures at the point above 65 F desired, usually at least 70 F in most buildings, the deficiency is made up by heat supplied by the heating system. The additional heat required from the heating system, due to other sources being lower than the standard upon which the 65 F degree day base depends, is equivalent to a heat loss, because it is a portion of the seasonal heat requirement. This additional heat is the difference between the standard unit heat gain and the actual unit heat gain as computed in our paper. A degree day base lower than 65 F should be used for buildings in which temperatures as high as 65 F are not desired.

This should not be confusing, considering our previous explanations above and Mr. Lewis' statements to the effect that heat reception undoubtedly does influence the seasonal amount of heat that must be supplied, and that all such figures are capable of wide variation.

7) *Mr. Lewis said that heat gain is not customarily considered in designing most heating plants.*

This situation is entirely as it should be in a vast majority of cases. We contend, just as logically, that in many cases the design loss has no more relation to the seasonal fuel consumption than heat gain does to the design load.

8) *Mr. Lewis said that he long ago abandoned the Guide crack method of computing air leakage and uses a percentage of the computed loss from exposed glass and wall areas.*

We don't criticize the method suggested in the Guide that doesn't give accurate results merely because the required measurements are difficult to obtain or because enough data on a sufficient number of various types of windows have not yet been compiled. The crack method is fundamentally correct. We criticize the methods suggested in chapter 11 for utilizing the wealth of information contained in other chapters. The material in chapter 11 is not arranged to consider all relevant information and that considered is merely a crude adaptation of design calculations.

9) *Mr. Lewis said, "The three major categories mentioned by Mr. Parsons all seem to be inherently included in the information developed in the design computations."*

We agree that the three categories which determine the heating requirements of any building are represented, but we do not agree that they are included completely. Ventilation frequently is a considerable factor, but is not included. The same applies to sun effect and others.

Regarding the information developed in the design computations mentioned by Mr. Lewis, it will be noted that the illustration of these computations given in table 5, page 135 of the 1945 Guide, lists percentage of design infiltration loss for an uninsulated residence, including a garage, at 12.8 per cent. Therefore, the total annual infiltration loss at the average infiltration rate would be about 6 to 8 per cent of the total annual loss. This percentage is near the extreme lower end of the infiltration range we suggested.

10) *Mr. Lewis stated, "from the data given in Mr. Parsons' memorandum, it is not easily practicable to learn what was the design hourly heat loss" from the Mutual building.*

The design hourly heat loss may be obtained merely by multiplying the unit design exposure loss, 19,690 Btu per degree per hour, by the design temperature difference. For a design temperature difference of 70 F, the design hourly heat loss is 19,690 $\times$ 70 or 1,378,300 Btu.

—R. A. PARSONS, Board of Water and Electric Light Commissioners, Lansing, Mich.

COAL VS. ANARCHY IN EUROPE, SAYS ICKES

The following is from a statement that Solid Fuels Administrator Harold L. Ickes made last month:

"In the light of reports received within the last few days on the desperate coal situation in Europe, I have come to the conclusion that, beginning at once, we should permit the shipment for civilian use in the devastated countries of approximately 6,000,000 tons of American coal between now and January 1, 1946, if possible.

"The race in Europe today is one between coal and anarchy. Europe must have coal without loss of time if serious political and social upheavals are to be prevented. I do not think that it is going too far to say that a coal famine of such severity as to destroy nearly all semblance of law and order is certain to occur in certain countries in northwest Europe next winter unless immediate and drastic action is taken now.

"I want the American people to know that this decision involves the risk that we may have to suffer a shortage of coal in this country next winter which will be more acute than heretofore predicted, and substantially greater than that which we experienced last winter. We may have to curtail industrial supplies to the point which will mean a partial or complete shutdown of some plants. We may even have to reduce the 80 per cent quota which we have fixed for domestic consumption.

"Shipments to Europe should prevent disorders which would cost American lives and they should enable the European countries to resume the production of food, textiles, and other materials which we would otherwise have to supply to Europe from our own depleted stocks.

"The latest estimates indicate that Europe will be 25,000,000 tons short of the coal that it needs between now and next April. And, when I say the coal that it needs, I mean only coal enough to keep the public utilities operating, enough fuel with which to cook, and to keep the water from freezing in millions of homes."

AIR CONDITIONING

1) Keeps Summer Output Up
2) Protects Parts and Assemblies
3) Allows Uniform Measurements
4) Permits Thorough Testing

at BENDIX RADIO

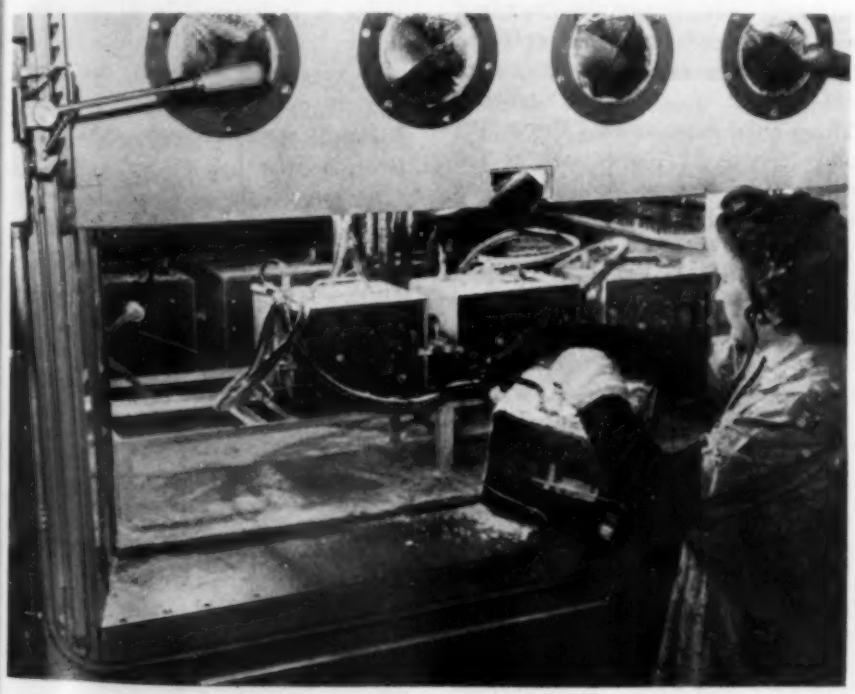
THE BENDIX RADIO division of the Bendix Aviation Corp. manufactures aircraft radio and communications equipment, including ground station and control tower equipment, radio compasses, automatic direction finders, receivers and transmitters; railroad radio; marine radio; and AM-FM radios, radio-phonographs, and television. The main plant is a two story insulated brick building in Towson, Md., a few miles north of Baltimore. Designed exclusively for precision radio manufacturing, this plant contains approximately 222,750 sq ft and was completed in March 1941. It is completely serviced by an air conditioning system which was engineered by the Argonaut Realty Div. and installed by Riggs Distler and Co., Inc.

With the exception of the executive offices and a few departments, the plant is windowless and has few exterior door openings. A semi-enclosed mezzanine runs the length of the building along one side, and many sections of the plant interior are completely enclosed with soundproof partitions. In addition to the long assembly lines, stockrooms, shipping rooms, and the executive offices, the plant has a large cafeteria and several test and research laboratories.

The various subdivisions and areas within the plant created a need for zones of differing temperatures. These areas include departments with blast and electric furnaces, ovens, heavy machinery and welding equipment; sections for paint spraying and tropicalization of radio chassis and components; long rows of assembly lines; laboratories simulating tropical and stratospheric conditions, receiving and shipping areas with huge sliding doors for truck entry; and offices for administrative deskwork—all in all, 60 different areas with more than 250 rooms.

With some 5000 employees working three shifts and the plant in continuous 24 hr operation, both air conditioning and acoustical control were required throughout.

Frost covered radio units under test in a climate conditioned test chamber . . . "air conditioning within air conditioning"



To provide the air cooling required in these various areas throughout the plant, two centrifugal refrigerating machines, employing "Freon 11," are used. One machine, of 250 ton cooling capacity, is driven by a sychronous motor, and one of 550 ton capacity is powered by a steam turbine. In the event of electrical failure of both the public power lines and the reserve generators, the steam turbine can continue to control plant temperature. Cooling water for these machines comes from two large cooling towers located outside the plant, each tower supplying 1250 gpm of water. Every 24 hr the water in these towers is analyzed; it is treated to prevent corrosion and organic growths.

A continuous supply of outdoor air is drawn into the plant for circulation throughout the various areas, the flow of this air being controlled by damper regulators. Large fans, plus several smaller units, provide the air velocity. Equipped with cooling coils for summer and heating coils for winter, these units are strategically placed to serve each area of the plant. Altogether there are 10 units: two fans supply 45,000 cfm; one fan supplies 35,000 cfm; four fans supply 28,750 cfm; one fan supplies 18,000 cfm; and two fans supply 8355 cfm. In each area the air is distributed by ceiling diffusers.

The boilers have water walls and are oil fired. They are completely automatic, with electronic combus-

tion controls, and operate at 150 psi pressure. Water balance in the boiler is maintained by constant analysis and inspection. A feedwater heater supplies feedwater at 222 F.

Throughout the plant, temperatures are checked constantly to assure that the automatic controls are performing effectively. Within each area of the plant, charts from hygrometers provide weekly reports on temperature and humidity. Daily reports are received from the boiler rooms.

Summer Output Would Drop 25% Without Conditioning

In summer, when the outside temperature is 90 F with 78 per cent relative humidity, the plant is maintained at 80 F and 50 per cent relative humidity. In winter, when the outside temperature is 0 F with 40 per cent relative humidity, the plant temperature is 70 F with a relative humidity 45 per cent. In actual extremes of 107 F and —3 F, comfortable temperatures have been maintained in the plant. When the first Army-Navy Joint E Award to a radio manufacturer was made to Bendix on August 10, 1942, thousands attending the outdoor ceremonies sweltered as the temperature soared into the 80's, with accompaning high humidity—inside, the plant was cool and comfortable.

W. P. Hilliard, the general manager of the radio division, says, "Our entire summer output would drop nearly 25 per cent if we did not have complete air conditioning in the plant." Increased employee efficiency, health and comfort, and decreased absenteeism—from absence of worker fatigue—are but a few advantages of air conditioning. Regulated humidity also eliminates corrosion of vital radio parts, and dust from assemblies.

The director of research and engineering, W. L. Webb, says, "I believe air conditioning has increased all engineering output and, in particular, that of engineering draftsmen, by 15 to 25 per cent. It has allowed uniform measurements to be made in the engineering laboratories. Some of the finest delicate precision test and measurement equipment in the aeronautical radio industry is kept dustfree and in accurate alignment in these laboratories, partly through air conditioning."

When in actual operation and use, the precision radio equipments manufactured at this plant are subjected to prolonged cold and extremes of heat and humidity in military and civilian operations all over the world. In the tropics, at a temperature of 48.7 C or higher, this radio equipment literally drips moisture. Sand and grit sift into delicate parts. But in a short time after takeoff, frigid conditions are encountered. Despite these sudden and prolonged changes, aircraft radio equipment must be designed and manufactured to operate instantly and continuously.

Improving the stability and performance of radio equipment in action depends largely upon improving its performance during tests in the plant. Test areas at the plant therefore simulate actual conditions in all war and operating theaters, and equipments are subjected to tropical and stratospheric conditions at will. In addition, air conditioning is extremely important in making precision electrical measurements, during which temperature and humidity must be held constant to avoid serious deviations.

Air Conditioning Within Air Conditioning

Climate conditioning, or air conditioning within air conditioning, has been successfully accomplished in numerous small climate chambers of 12 to 15 cu ft capacity. These chambers, using "Freon 12" and "Freon 22," are part of the production testing facilities. The working temperature range is from —40 C to +50 C, in two hours. The design of electronic equipment containing stable oscillators, and standard capacitors and resistors, is simplified, in most cases, by the elimination of temperature controlled ovens.

In this aspect of the work, the advantages of mechanical refrigeration over other methods of cooling are: (1) relatively constant humidity; (2) accurately controlled temperature at subzero levels; (3) controlled rate of temperature decline; and (4) improved working conditions for operators. In some cases, the cost of such component parts as crystals and capacitors is reduced owing to the narrow operating temperature range required.

Climate rooms of measurements and standards engineering at Bendix use a two stage "Freon 22" system. These are three large test rooms, 12 ft x 14 ft x 9 ft each. Room Number 1 can be adjusted from —60 C to +90 C with no control over humidity. Resistance of equipment to thermal shock is tested here. This room can be cycled from +20 C to —60 C in six hours; from —60 C to +90 C in two hours. Personnel working in this room wear electrically heated clothing when temperatures drop below —20 C. Room Number 2 operates continuously at 50 C with 95 per cent relative humidity. Room Number 3 can be cycled in both temperature and humidity from +15 C to +60 C. Relative humidity is cycled between 10 and 100 per cent, and can be shifted one per cent per minute in either direction. Fans move 5600 cfm of air here.

Measurements and standards engineering is adding a room in which a direct expansion "Freon 22" system will maintain a constant temperature of 25 C ($\pm\frac{1}{2}°$), with relative humidity not exceeding 40 per cent. Primary standards —power factor, resistance, inductance, and capacitance—are to be stored and compared here. Such standardization is necessary because it is impossible to make accurate measurements when humidity exceeds 50 per cent. Even the breath of the operator will unbalance some delicate measuring equipments.

In no small measure, the high degree of accuracy demanded and met at Bendix comes from controlled temperatures and humidity, through plant air conditioning and through "air conditioning within air conditioning."

Do All You Can to SAVE FUEL!

Analyzing Piping Stresses by Tests of Models

By Lale C. Andrews, Mechanical Engineer
The M. W. Kellogg Co

THE SOLUTION of the problem presented by thermal expansion has become fundamental in the design of modern high temperature piping. Progress in the oil, chemical, and power industries has brought large diameter pipe lines, often operating at red-heat temperatures. Such lines, improperly designed, may act with destructive force upon themselves or the equipment to which they are connected. Hence, their advent, in increasing complexity, has made acute the necessity of analyzing their flexibility characteristics.

The mathematical analysis of end reactions and stresses in pipe lines under thermal expansion has been developed for the general case. Theoretically, a piping system of any complexity, composed of any number of different materials, and subject to any combination of temperature conditions, can be analyzed for flexibility by mathematical means.

18 Simultaneous Equations

In adapting the theory to routine solutions, however, a practical limit is soon reached due to the arithmetical labor involved. The determination of the end reactions of a single branch pipe line requires the solution of six simultaneous equations. Each additional side branch increases the number of equations by six, and increases the work required for their setting up and solution almost in proportion to the square of their number. The analysis of piping systems of four points of fixation, involving the solution of 18 simultaneous equations, has been found to be about the practical limit for the mathematical approach.

This limitation has given rise to the use of the scale model as a means of solving more intricate layouts. In order to make effective use of this method of analysis, a special laboratory is maintained by the author's company for routine tests and development in this field.

Principle of Model Test

The principle employed in the model test method developed by the company is that of displacing the ends of the model pipe line with relation to an assumed fixed point and measuring the end reactions. The displacements applied are proportional to the calculated free thermal expansions of the ends from the fixed point. The forces and moments thus created at the ends of the model are proportional to those applied to the end anchors by the pipe line under actual thermal expansion.

PROGRESS IN the oil, chemical, and power industries has brought large diameter pipe lines, often operating at red-heat temperatures. Such lines, if improperly designed, may act with destructive force upon themselves or the equipment to which they are connected. Thus the necessity of analyzing their flexibility characteristics is acute . . . Such an analysis, however, is quite complicated and time-consuming by straight mathematical calculation. By means of model tests, the job is simplified. For example, the mathematical analysis of a piping system such as can be accommodated by the test apparatus shown in Fig. 1 would require the solution of 73 simultaneous equations.

The model may be constructed of either solid rod or tubing of any material of uniform modulus of elasticity, regardless of the material of its fullsized counterpart. A good grade of cold rolled steel rod has been found satisfactory for most tests. Where the flattening effect of the curved or mitered portions of the pipe is an important factor, steel tubing may be used.

Choice of the length scale is largely a matter of convenience in setting up in the testing apparatus. Where only one pipe size, temperature, and material are concerned, any convenient rod or tubing size may be used. Where, however, more than one of these factors is involved, the ratio of the products of the moments of inertia by the moduli of elasticity of the various parts of the pipe line must be maintained in the model. A range of rod diameters from ⅛ in. to ½ in., varying by 64ths, has been found to cover practically all combinations of pipe sizes the flexibilities of which appreciably affect each other. Joints may be brazed or welded, carefully fitted brazed joints having been found satisfactory.

End fixation is of extreme importance, since a comparatively small rotation can so relieve the stresses in the system as to nullify the results. To insure fixation, it has been found desirable to silver solder each end of the model into a drilled block suitable for firmly attaching to the measuring unit.

Rods may be bent cold but the corners are stress relieved to avoid erratic readings due to the gradual release of locked-up stresses.

The Testing Apparatus

The model testing apparatus, as shown in Fig. 1, consists of a sup-

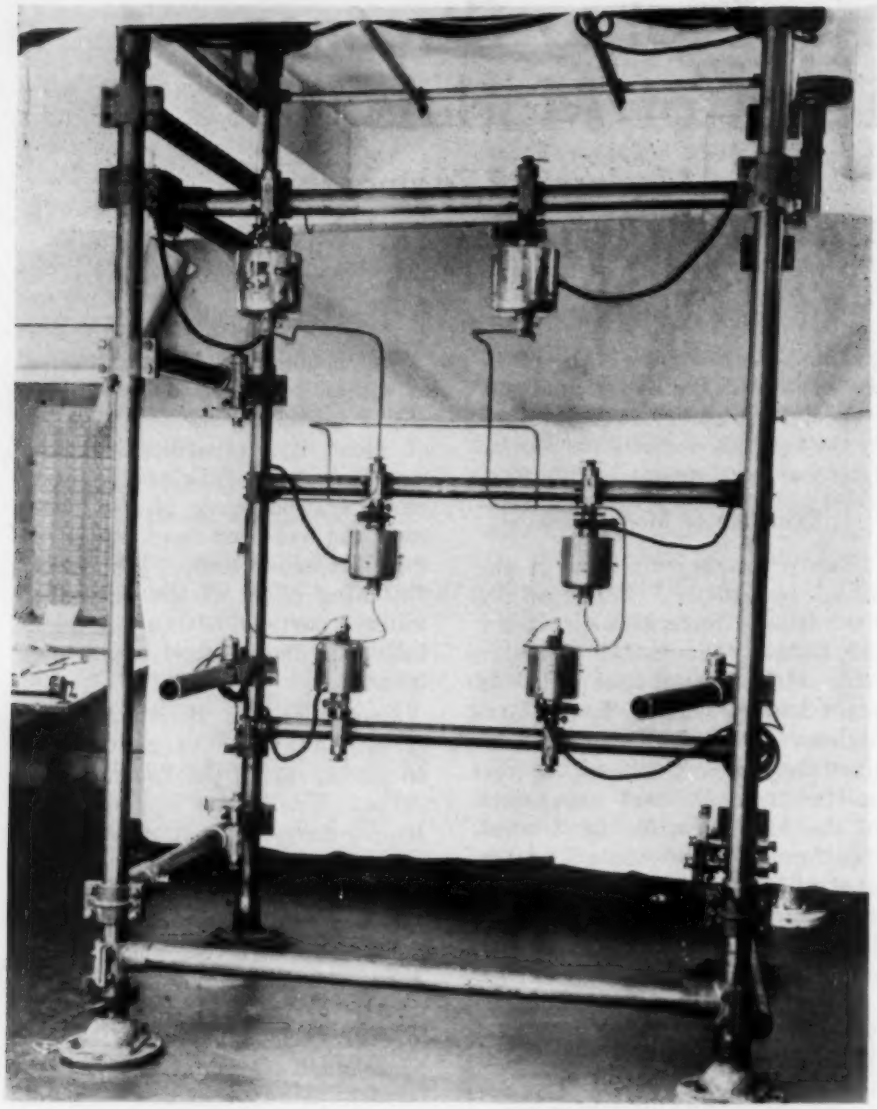


Fig. 1—General view of model testing apparatus, showing model of 12 in. 1250 psi steam line attached to electrical measuring instruments for determining end reactions

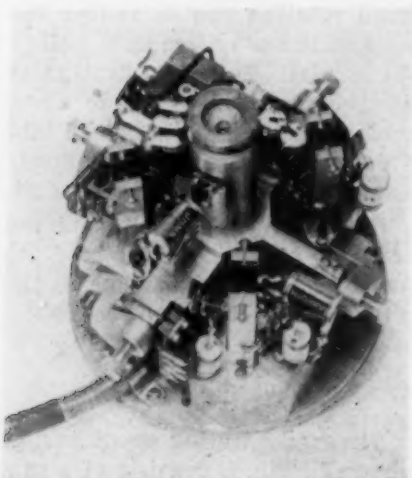
porting framework to which may be attached the mechanical units for displacing the ends of the model and the electrical units for measuring the resulting reactions, an electrical control panel, and galvanometer. Equipment is available for accommodating piping systems up to 12 points of fixation with seven intermediate partial restraints. The mathematical analysis of such a system would require the solution of 73 simultaneous equations.

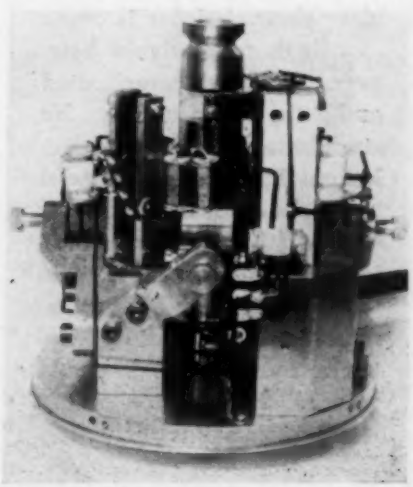
The framework consists of four machined tubular steel posts, extending from floor to ceiling. Between each pair of posts extend two machined tubular arms, removably clamped to the posts, to form a rigid, box-like structure. To the arms and to the posts, other shorter arms may be clamped so as to give access to any point in space within a radius of from 5 to 7 ft. Auxiliary equipment extends this reach to any point in the room.

The arms are splined to receive the micrometer units for applying the component displacements to the ends of the model in the directions of the coordinate axes. These units consist of two mutually perpendicular slides, each of which is operated by a lead screw with thimble graduated in thousandths of an inch. The top slide, which carries the removable measuring unit, swivels through a complete circumference, so that the resultant of two component movements may be applied.

Electrical Measuring Instruments

The electrical measuring instruments—the most advanced feature of the apparatus—are designed to resolve the force and moment at each end of the model and to





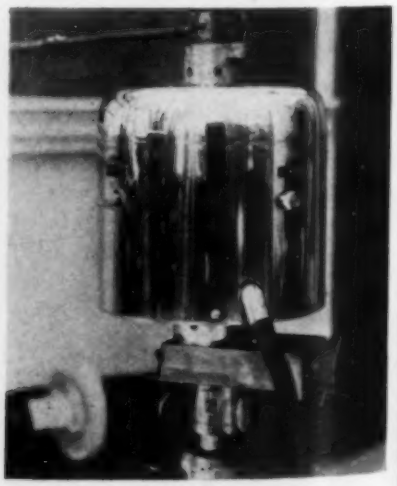


Fig. 2—Three views of the electrical measuring instruments. The internal views show the six-arm cross which resolves the force and moment applied by the model, the cantilevers which deflect in proportion to the component forces, and the Wheatstone bridge wiring. The assembled view shows how the model is attached to the cross, and the micrometer unit for applying the displacements to the end of the model

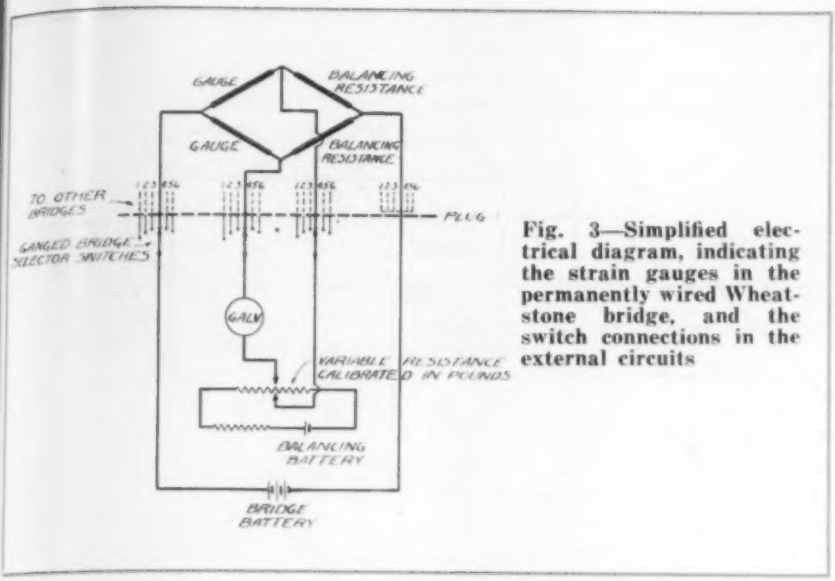


Fig. 3—Simplified electrical diagram, indicating the strain gauges in the permanently wired Wheatstone bridge, and the switch connections in the external circuits

measure the resulting three coordinate components of each. This is accomplished by applying the force and moment, by means of a six-armed cross, to the deflection of six cantilevers aligned with the three coordinate planes. To the cantilevers are affixed six pairs of electrical strain gauges, the resistances of which vary in proportion to the deflections. By measuring the changes of resistance of the various strain gauges, the component forces and moments may be determined.

The measurement is accomplished by the Wheatstone bridge method, each pair of gauges being permanently wired into a completed bridge. The galvanometer and battery leads from the six bridges are then brought from each unit by means of a 19-wire cable terminating in a jack plug. The delicately balanced bridge circuits are thus never broken, all switch connections occurring in the comparatively insensitive battery and galvanometer circuits. Since all gauges in all of the instruments must be calibrated exactly alike, and each gauge must read with precise consistency, it is of prime importance to avoid the effects of uncertain switch contacts. The construction of the measuring units is illustrated in Fig. 2 and the basic circuit is shown in Fig. 3.

The gauges in each measuring unit are read by plugging the jack plug of the unit into the control panel receptacle and switching from gauge to gauge. Changes of resistance due to forces applied are indicated by the galvanometer which is reset to zero by means of a second battery circuit. The variable resistance in this second circuit is calibrated directly in pounds. Hence, when the galvanometer reads zero, the control panel dials indicate the load in pounds on a given cantilever. The potentials of the two battery circuits are kept equal by suitable variable resistances, and are constantly checked by a microvoltmeter. The galvanometer was built to order and is of somewhat greater sensitivity than the usual laboratory instrument. The individual load range for one cantilever is from 0.01 to 50 lb.

Readings Taken

When the model has been set up ready for testing, an initial or

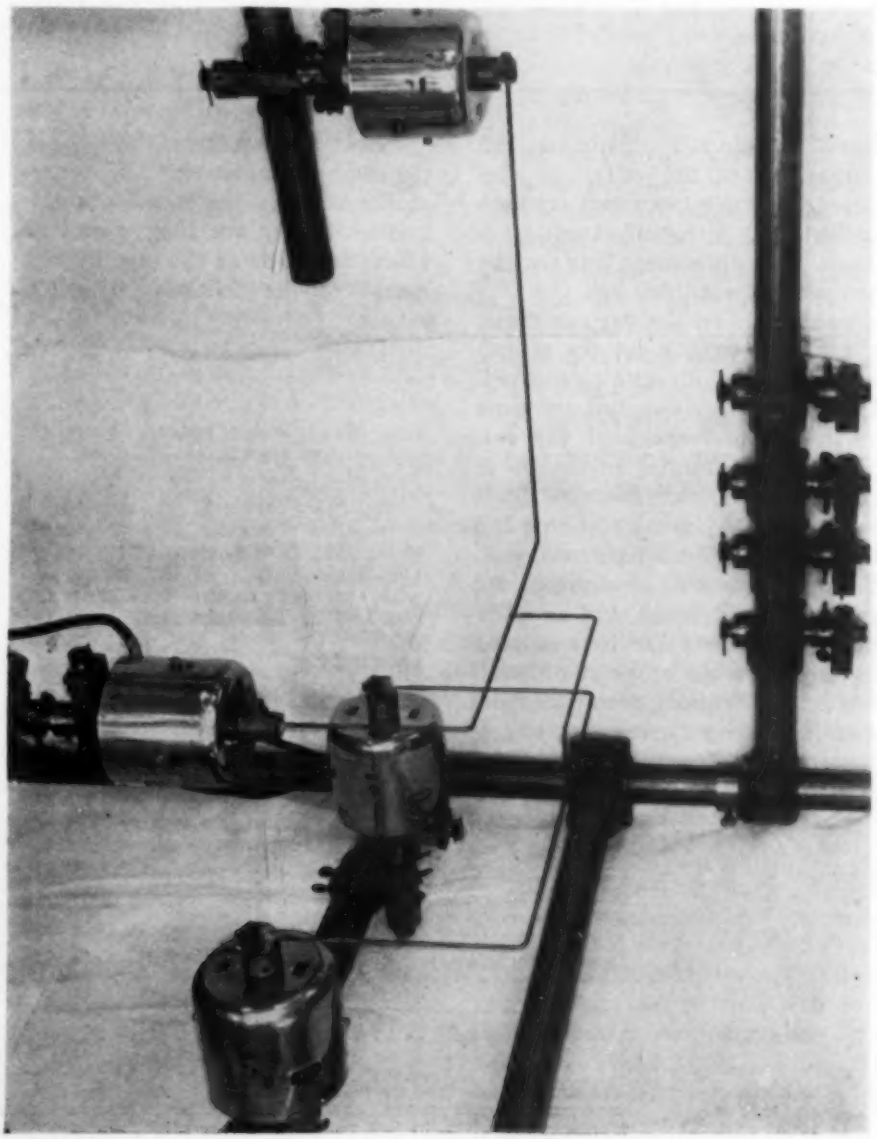


Fig. 4—Model of 16 in. and 14 in. 900 F chrome-moly oil lines for a catalytic cracking unit. This routine model test was in progress at the time this article was prepared, and was chosen as a random selection for calculation. The comparative results are presented and discussed

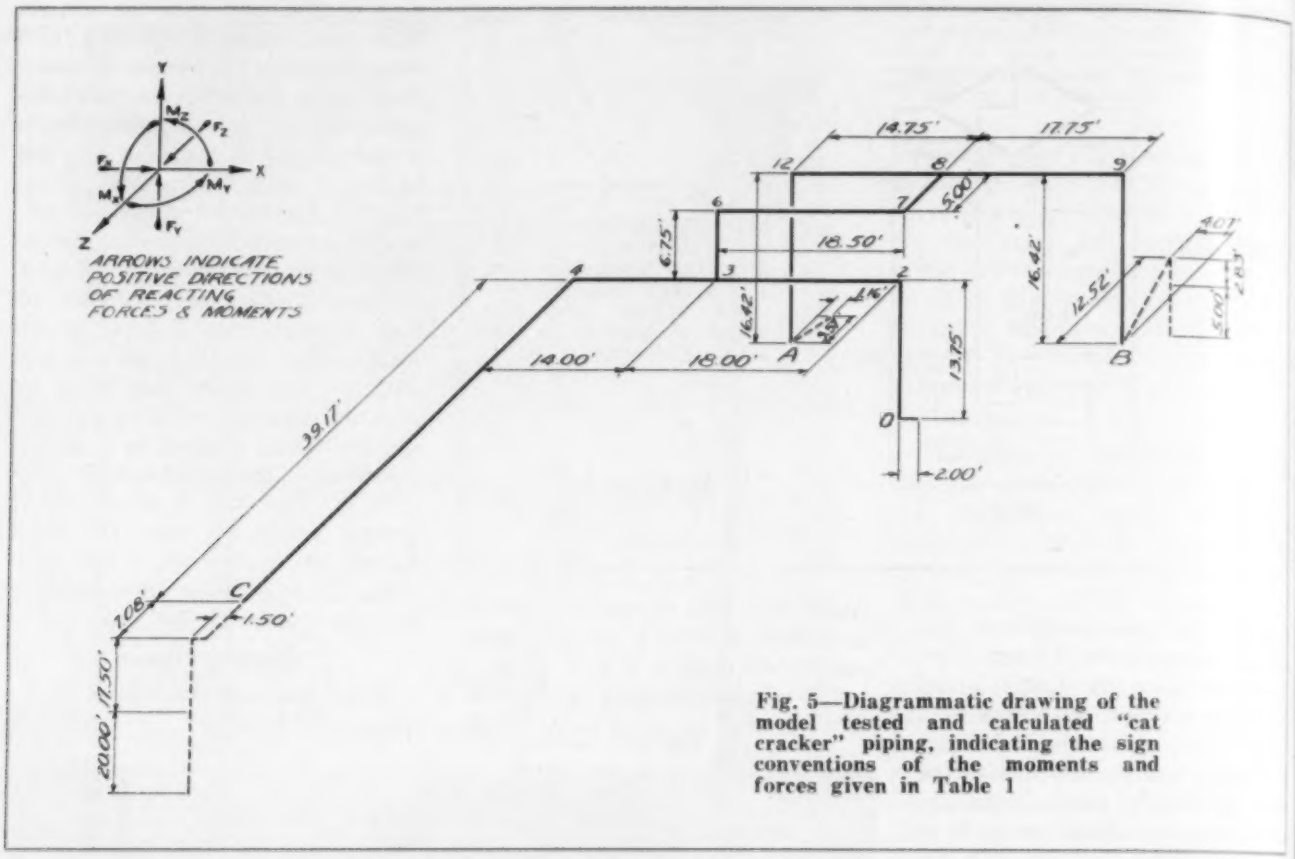


Fig. 5—Diagrammatic drawing of the model tested and calculated "cat cracker" piping, indicating the sign conventions of the moments and forces given in Table 1

"zero" reading is taken on all gauges before the ends are displaced. The displacements are then applied and a second reading is taken. The differences between the two sets of readings are the significant loads on the various cantilevers, from which the forces and moments are directly computed. The displacements applied are some convenient percentage of the calculated free thermal expansion of each end from an assumed fixed point which is usually one of the ends or an intermediate restraint. Usually, three sets of readings are taken to avoid errors and an additional check is made by summing up the forces in each set of readings. Any marked deviation from zero indicates an error.

From the readings thus taken the component moments and forces at the ends of the model are calculated. They are then converted to the full scale of the pipe line by means of the following relationships:

$$\frac{F_p}{F_m} = \frac{E_p I_p}{E_m I_m} \times \frac{\triangle_p}{\triangle_m} \times \frac{L^2_m}{L^2_p}$$

$$\frac{M_p}{M_m} = \frac{E_p I_p}{E_m I_m} \times \frac{\triangle_p}{\triangle_m} \times \frac{L^3_m}{L^3_p}$$

where F = force; M = moment; E = modulus of elasticity; I = moment of inertia; $\triangle$ = amount of expansion (or displacement) of the "free" end with reference to the fixed end; and L = length. The subscripts m and p refer to the model and the pipe, respectively.

The moments thus obtained may be transferred mathematically to critical positions on the pipe line and the maximum stress calculated.

Comparison Between Model Test and Calculation

The pipe line, the model of which is shown in the testing apparatus in Fig. 4, has been both model tested and calculated. It consists of four points of fixation and was chosen for comparison because it requires for its mathematical analysis the solution of 18 simultaneous equations, the practical limit of computation.

A diagrammatic illustration of the pipe line is shown for reference in Fig. 5. Dotted lines indicate equipment that is considered infinitely rigid, yet contributes thermal expansion to the system.

Table 1—Moments and forces acting upon anchors

Point	M_x	M_y	M_z	F_x	F_y	F_z
Model Test Values						
O	— 41,664	— 47,825	+ 30,892	— 1,138	— 986	— 2,730
A	— 38,854	— 1,219	+ 10,924	+ 1,213	+ 3,944	— 2,351
B	— 28,515	— 13,167	— 52,103	+ 5,688	— 1,744	— 1,668
C	— 40,062	+ 108,826	+ 4,528	— 5,536	— 1,668	+ 6,901
Maximum stress = 19,277 psi at point 5.						
Calculated Values						
O	— 42,103	— 47,568	+ 30,098	— 1,120	— 788	— 3,205
A	— 38,284	+ 13	+ 10,513	+ 1,220	+ 4,041	— 2,326
B	— 27,657	— 12,535	— 56,508	+ 6,007	— 1,786	— 1,509
C	— 41,862	+ 115,750	+ 4,631	— 6,107	— 1,467	+ 7,040
Maximum stress = 20,415 psi at point 5.						

Moments are given in foot-pounds and forces in pounds.

From the comparative results given in Table 1, a discrepancy of about 5.6 per cent will be noted between the maximum stresses found by the two methods. Comparable disagreements will be found in the forces and moments at *C*, from which the maximum stress was computed.

The only striking discrepancy in the results occurs in the *y*-moment at end *A*, an insignificant component of the resultant moment at this point. In this case, analysis shows the true meaning of the differences in the component moments to be a difference in the resultant moment of 1.7 per cent, and in its angle of application of 1 deg 47 min. For the benefit of the critical reader, the stress has been computed at the three significant locations affected by this value. The results are:

Location	A	12	S
Stress from calculation	8363	6571	9391 psi
Stress from model test	8494	6633	9425 psi

Every Factor Must Be Carefully Analyzed

These figures should not be construed to mean, however, that a successful model test will result from crude equipment or slovenly technique. The effect of every factor must be carefully analyzed and its importance evaluated. For instance, in the mathematical transfer of moments from the point of measurement to critical locations on the pipe line, small errors in measurement can, under certain conditions, become magnified out of all proportion to their apparent original significance. An examination of the following equations of moment transfer will make this clear.

$$M_{x_a} = M_{x_0} + F_{y_0} \times Z - F_{z_0} \times Y \ldots [1]$$
$$M_{y_a} = M_{y_0} + F_{z_0} \times X - F_{x_0} \times Z \ldots [2]$$
$$M_{z_a} = M_{z_0} + F_{x_0} \times Y - F_{y_0} \times X \ldots [3]$$

where M_{x_0}, M_{y_0}, M_{z_0}, F_{x_0}, F_{y_0}, F_{z_0} are the given moments and forces at a point 0 and M_{x_a}, M_{y_a}, M_{z_a} are the moments required at point *A* with coordinates *X*, *Y*, *Z* from 0.

Let us consider equation 3. If M_{z_0}, F_{x_0}, and F_{y_0} are small and *X* and *Y* are large, small numerical errors in F_{x_0} and F_{y_0} can cause large errors in M_{z_a}.

This condition is aggravated by the circumstance that the forces and moments are each the sum or difference of two quantities, each of which, in turn, is the difference of two readings.

In order to reduce these cumulative errors to a negligible magnitude, the equipment described here was designed to measure to 1/50 of 1 per cent of the maximum allowable load, and the testing technique was developed to minimize all recognized sources of error.

Determining Deflections of Pipe Line

In addition to determining the end reactions and stresses, the equipment has been found useful in quickly determining the deflections at any point on the pipe line. This information is of particular value in designing spring supports. The measurements are taken with a dial micrometer and corrected mathematically for the expansion conditions of the pipe line.

The function of the model tester is several fold. On problems of moderate complexity, it is a time and labor saver. On piping systems of greater intricacy, it offers a complete analysis to replace the approximations formerly employed.

It has been found useful in the multiple solutions of problems involving different temperature conditions. The effects of changes in the piping configuration can often be studied with comparative ease, as well as the placing of supports, guides, wind struts, and vibration snubbers.

In certain cases, it has offered visual evidence of obscure effects determined by mathematical means. And it is becoming a valuable tool in the investigation of some of the fundamentals of piping analysis.

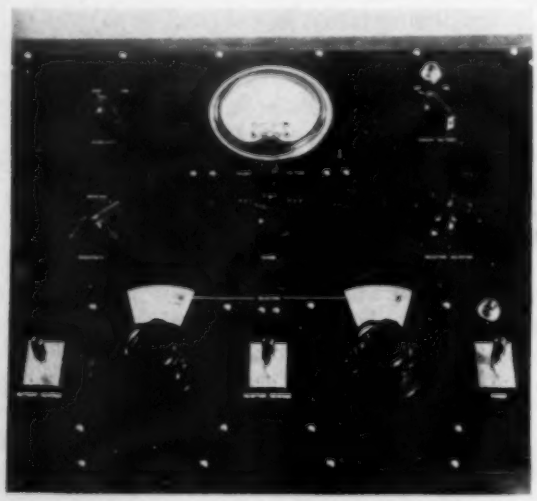


Fig. 6—Control panel. Loads are read in hundredths of a pound, and directional signs indicated on the two lower dials

STOKER MAKERS STREAMLINE MEETING

Arrangements have been completed to hold the annual meeting of the Stoker Manufacturers' Association at the Stevens hotel, Chicago, August 22. This meeting will be a one day business conference, streamlined to conform with government regulations governing the holding of meetings. Business sessions will be held in the morning and afternoon with a group luncheon and the annual dinner in the evening. In order to comply with government regulations, attendance is restricted to members and associate members of the SMA.

CONSTRUCTION SHOW FOR LOS ANGELES

Viewed as an activity which will "go far in advancing construction of all kinds in underhoused, overcrowded Los Angeles," it has been announced that the Chamber of Commerce will sponsor a construction exposition, the date for which tentatively has been set for next spring. Eight Los Angeles county construction contractors' associations are joining up with the chamber in sponsorship of the event.

The show will be a means to display new materials and methods available to the public for all classes of construction. Exhibits will feature designs for commercial, industrial, housing, and public works construction, as well as equipment and appliances for homes.

NEW BOOKS & REPORTS

Piping Handbook

The increasing importance of piping in power plants, distribution systems, and industrial operations—together with the specialized nature of the problems involved—led to the publication, in 1930, of the first edition of the Piping Handbook. The reception accorded the first three editions of this now-standard work—and the scope and content of the new fourth edition, which was published last month—attest the need for such a book.

The author of the Piping Handbook is Sabin Crocker, senior engineer, engineering division, the Detroit Edison Co.; member of the ASA sectional committee on the code for pressure piping, and chairman of its subcommittee on scope and intent; and member of the ASA sectional committees on standardization of pipe flanges and fittings, and on standardization of wrought iron and wrought steel pipe and tubing. Mr. Crocker is a member of HPAC's board of consulting and contributing editors, and the author of many articles on piping and heating boiler selection published in our pages.

Owing to his preoccupation with other affairs, J. H. Walker was unable to participate fully in preparation of the fourth edition, and his name no longer appears as co-author of the handbook; however, he took part in the revamping of the chapters on heat insulation, building heating systems, and underground steam piping.

The fourth edition has 1391 pages, as compared to 908 pages in the third edition which came out in 1939. Chapters have been added on gas piping, refrigeration piping, hydraulic power transmission piping, and corrosion (including protective coatings). The discussion on water supply piping has been considerably augmented, and much material has been added to the section on flow of water in pipes, which now includes the Scobey, Williams-Hazen, and Kutter-Manning formulas.

In addition to the subjects which have been mentioned above, there are chapters on definitions, formulas, and tables; properties of fluids; metallurgy of piping materials; pipe, valves, and fittings; hangers and supports; expansion and flexibility; steam power plant piping; plumbing systems; fire protection piping; and oil piping. A carefully-compiled cross-index of 26 pages facilitates use of the great amount of information presented.

Growing interest in the "rational formula" or Reynolds number type of solution for fluid flow problems has led to an elaboration of this subject and to providing a greater variety of rational formulas in which all constants have been adjusted to suit using a common friction factor f which can be determined from one of two figures presented. In order to obviate the necessity for making cut-and-try solutions in solving certain problems by this method, a new system for making direct rational solutions in such cases has been provided in a figure and a table. A special effort has been made to define all the symbols used in the flow formulas and to follow this code uniformly throughout the chapter on flow. This has involved some changes in terminology from the earlier editions.

The area-moment or grapho-analytical method for solving piping flexibility problems, which was introduced with the first and second editions, has found extensive use and is generally recognized as giving as refined a solution as is worthwhile attempting in practical applications. Although a solution by this method can be made as rigorously exact as circumstances warrant, it is advisable to ignore certain minor rotations in any method of solution in order to keep the work within reasonable bounds. Accordingly, the original method has been continued unchanged, but simplified solution charts for certain frequently encountered shapes of bends have been added from time to time.

All existing codes, dimensional standards, and materials specifications for piping abstracted in the earlier editions have been revised to date and abstracts added for those formulated since. Abstracts and references embrace standards and codes of the American Standards Association, the American Society of Mechanical Engineers, the American Society for Testing Materials, the American Water Works Association, the National Board of Fire Underwriters, the American Society of Heating and Ventilating Engineers, and others. For the convenience of those desiring further information, it is indicated where unabridged versions of the latest drafts of such standards may be purchased.

The Piping Handbook has 1376+xv pages, 4½ by 7 in., with many tables, charts, graphs, and sketches. It is published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Its price is $7.00.

Fuel Conservation in Hospitals

The council on hospital planning and plant operation of the American Hospital Association, 18 E. Division St., Chicago 10, Ill., has issued a booklet on fuel conservation in hospitals which covers the purchase and combustion of coal, oil, and gas, and the production, distribution, and use of steam. It comprises 62 pages, 6 x 9 in., and may be purchased from the AHA for 75c with a paper cover or $1.00 with cloth cover.

According to Frank R. Bradley, M.D., chairman of the council on hospital planning and plant operation, in his foreword, "The power plant has so long been the step-child of the hospital that it is highly probable that it now represents the one department most susceptible of improvement in economy in the entire hospital." Dr. Bradley acknowledges the work of Dr. W. P. Morrill, AHA's director of research, for the preparation of the text, and the help of John Howatt, business manager and chief engineer of the Chicago Board of Education, for his critical reading of the text and his many constructive suggestions.

The bulletin has sections on the selection, purchase, and storage of fuel; combustion with hand firing, stokers, oil, and gas; steam production and feedwater treatment; instruments and control methods; and steam consumption—including general steam distribution, return lines, use of steam, space heating, heating systems, controls, water heating, domestic circulation, laundry, kitchen, sterilizing, and power. Nineteen illustrations, some in two colors, supplement the text.

In the summary, it is stated that rehabilitation and modernization "are of course the logical first steps" to economy and that "the power plant offers the largest single opportunity for economy of any department of the hospital." Even without major changes, increased supervision alone will show unexpectedly large economies, according to the study. The first step in achieving economy is "to select the fuel best suited to the apparatus available"; mechanical firing equipment "will usually pay for itself in less than three years" as compared to hand firing.

Space heating is reported to be "the major consumer of steam," and the "closer the approach to central automatic control" the greater the economy in its use. Decrease of heat losses around door and window frames, and adequate trapping of all condensate lines, are recommended particularly.

Arc Welding Electrodes

The continual increase in the applications of metal arc welding may in part be ascribed to the concurrent advance in the development of new and improved types of electrodes, each designed to do specific jobs in the most efficient manner. To provide for classification of the various types, the American Welding Society and the American Society for Testing Materials have jointly undertaken the formulation of specifications for these materials.

The largest volume of electrodes produced is for the welding of mild and low alloy steels. Electrodes of this type, identified by the well-known classification numbers E6010, E6011, etc., are covered in Tentative Specifications for Iron and Steel Arc Welding Electrodes. This standard has been in use for several years and has been revised periodically. The most recent revision has just been completed. The new issue, carrying the designation A233-45T, embodies revisions which, while making some modification of previous test requirements, are primarily intended to clarify these test requirements by more specific definition of what is required for each classification, and how the required tests are to be performed. For more ready reference, test conditions and results have been included in tabular form, and a new table has been added summarizing all test requirements.

In the course of preparing this revision it was recognized that there are much data on electrodes which, while not proper for inclusion in the specifications, would be useful to potential users in guiding them toward an understanding of the best suited applications for the various electrode classifications established by the specifications. To provide this information the Guide to AWS-ASTM Classification of Iron and Steel Arc Welding Electrodes has been prepared to supplement the specifications and has been included as an appendix to them.

This guide explains the concept of the classification numbering system used in the specifications and a discussion of each electrode classification in the E60 series as to type of coating, suitable currents and voltages, and mechanical properties. Also included is a list of codes with which each classification complies.

Individual copies of the revised specifications A233-45T, and the appended guide, may be obtained from either the American Welding Society, 33 W. 39th St., New York 18, N. Y., or the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., for 25c.

Cast Iron in the Chemical and Process Industries

Extensive data on the corrosion rates of cast iron exposed to the action of substances commonly handled by chemical structures feature a pamphlet entitled Cast Iron in the Chemical and Process Industries recently published by the Gray Iron Founders' Society, Cleveland 13, Ohio, and Washington 6, D. C., national association of manufacturers of engineering gray irons. It is the work of F. L. LaQue, head of the corrosion engineering section of the International Nickel Co., Inc.

Results of laboratory and plant tests with more than 300 corrosive media in an alphabetical range from acetic acid to zinc sulfate are shown. The four appended tables also list the many chemicals regularly handled by cast iron pumps and valves and those resisted satisfactorily by high silicon irons.

Factors dictating cast irons for corrosive service, the availability of the material, design for chemical industry equipment and many specific applications are discussed in the text of the 28 page publication. Pointing to the corrosive-service-per-dollar factor, the booklet states that in some applications the nature of the corrosive media is such that, despite a fairly rapid attack on cast iron, no other material can be expected to render long enough service to justify a higher initial cost.

Differences in the manner in which cast iron resists corrosion, the pamphlet notes, are related directly to the structure of the material and, particularly, to the presence of graphite flakes in a ferritic, pearlitic, or austenitic matrix. The corrosion resisting characteristics of gray iron may be altered by alloying and by foundry techniques since both affect the size, shape and distribution of the graphite particles and influence the corrodibility of the matrix.

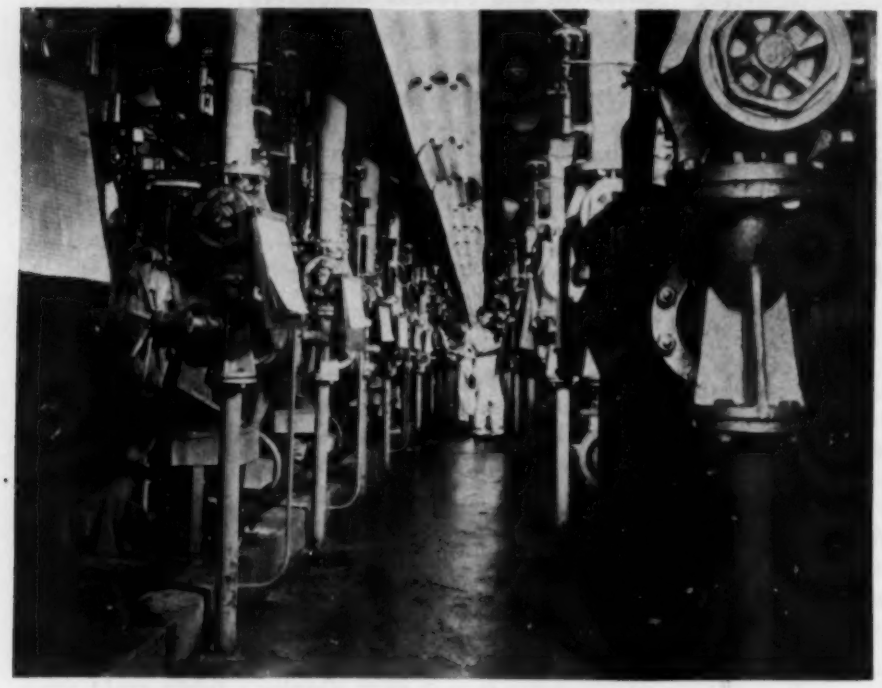
The pamphlet is available for $1.00 from the society's Cleveland or Washington offices.

Electric Water Heaters

Test specifications for automatic electric storage water heaters are given in a report of a joint committee of the Edison Electric Institute and the National Electrical Manufacturers Association. The purpose of the specifications is to establish a procedure to make possible the determination of the performance of such heaters in terms of safety, effectiveness, durability, and convenience with respect to minimum requirements. Identified as EEI publication F8 and NEMA publication 103, it is available from the EEI, 420 Lexington Ave., or the NEMA, 155 E. 45th, New York City, for 20c to members and their employees, 50c to non-members in the U.S.A., or 60c in foreign countries. It comprises 10 pages, 8½ x 11 in.

The NEMA has also issued recently an eight page publication, No. 45-104, on standards for electric water heaters, the price of which is 25c.

HEAT INSULATION for PENICILLIN PROCESS



A complicated system of sterile air ducts, steam valves, filters, control instruments and other equipment regulates the propagation of the parent mold which yields the drug penicillin. Eighty-five per cent magnesia insulation aids precise temperature control of the process, and contributes to production economies

MANY FACTORS have contributed to the phenomenal results which have been attained in the production of penicillin. The purpose here is to point to just one of these factors as a typical, but important, example—the problem of the precise temperature control required and how heat insulation is employed at the Lawrenceburg, Ind., plant of Schenley Laboratories, Inc., a subsidiary of Schenley Distillers Corp. With an extensive background of experience in the study of cultivation of various types of molds, the staff of Schenley's research institute was early interested in mass propagation of the drug. Their initial experiments were followed in 1943 by success with pilot scale operation and this led, in 1944, to the construction and equipping of this commercial plant.

The problem of insulation is an important one because the processes of manufacturing penicillin are so precise in each step of the operation that definite temperature controls are necessary. There are four main steps: (1) steam sterilization, requiring temperatures of approximately 250 deg; (2) propagation, requiring temperatures of 65 or 70 deg; (3) recovery, about 40 deg; and (4) the finishing process, where temperatures range from 80 deg below zero to 185 deg. It is the job of insulation to aid in holding these critical process temperatures within close tolerances; in this case, the value of the heat saved is of secondary importance to the accuracy of temperature maintenance.

Standard thick 85 per cent magnesia block is used on the sterilizers, drums, percolators and other equipment-in-bulk in which protection for temperatures up to 600 deg is required, and standard thick magnesia segmental pipe covering is used on all hot lines at the Lawrenceburg plant.

Increasing Importance

The attention given to insulation at this plant is a reflection of the ever increasing importance which business and industry are giving to thermal insulations and their proper use. Fuel, power, and labor costs are mounting steadily, and under such conditions the economies which can be effected by efficient insulation are significant. As boiler and process temperatures continue to increase, insulations are relied upon to minimize losses. In the production of penicillin, this consideration is important both from the standpoint of economical production for war needs and future production for peacetime needs.

Freeze-drying of penicillin salt solution is regulated from this control board

...on Operation, Maintenance, Repair, Alteration, Extension

Cleaning 15 Miles of Air Ducts

By Harold M. Toombs, Chief Engineer
The Stevens Hotel

ONE OF THE major tasks that was involved in the recent rehabilitation of the Stevens hotel, Chicago, was the cleaning of 15 miles of air supply and exhaust ducts. Many are hidden from view, being buried in walls and between floors and ceilings. Those that are exposed twist and turn, resembling a mass of cooked spaghetti.

The necessity for cleaning ductwork is never concealed, for visual evidence is abundant. Dust, dirt, and lint is all over, like moss growing on a shingle roof. Ceilings adjacent to air outlets have the typical ballooned, "four o'clock" shadow. Specks of ash float in the air. Exhaust grilles are unsightly. When fans are brought to top speed too suddenly, occasional dust storms make their appearance. Futuristic patterns stand out from white painted surfaces. Dirt camouflages the edges of access doors to pipe shafts.

Artistically designed and beautifully conceived bronze grilles are not conducive to uniform air distribution. Wire netting had prevented the mice from playing hide and seek in the exhaust ducts, but the mesh was bridged with dirt—more effective than a closed damper. Ducts supplying cold air lose their effectiveness when not insulated. Drafts were common. There was an air shortage under heavy loads, sometimes resulting from a long forgotten, concealed damper located a city block from the room supplied.

Cleaning Problem a Tough One

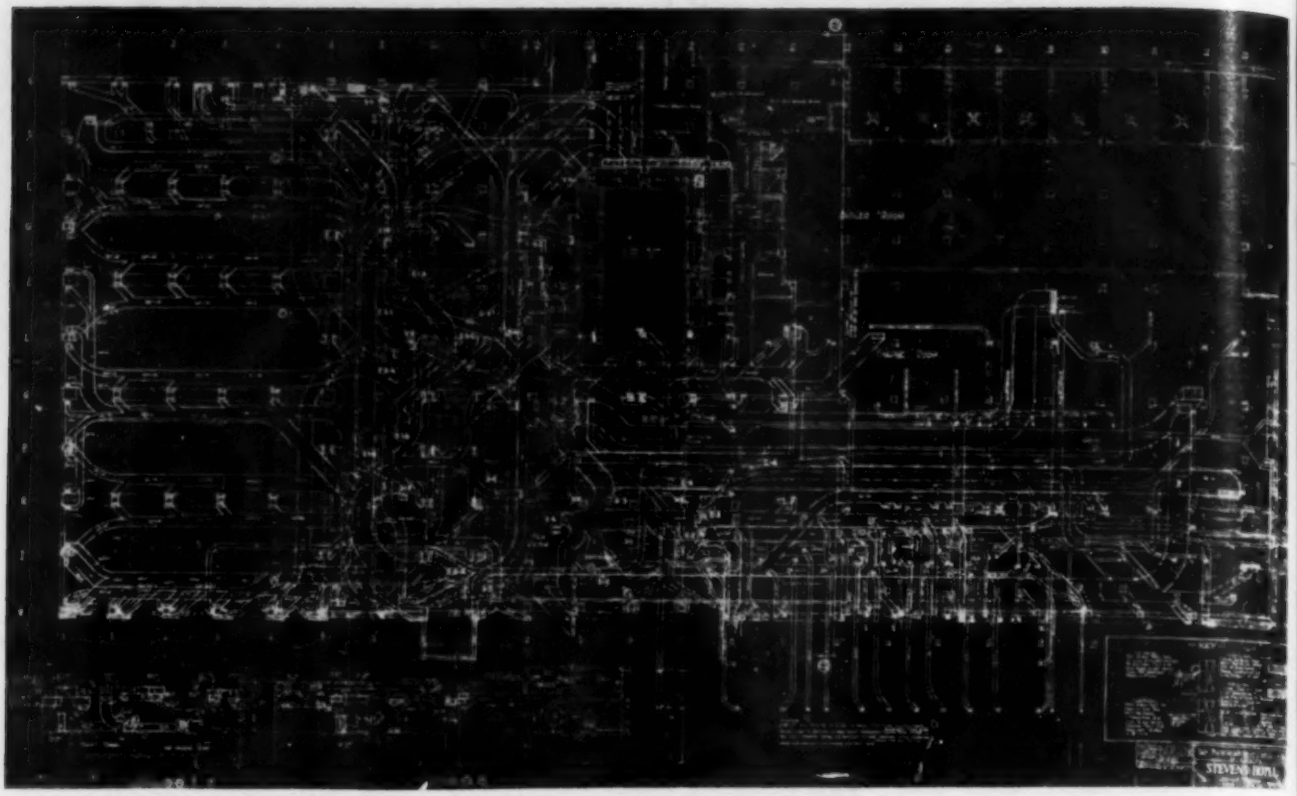
The problem of cleaning seemed a tough one. Contractors were not interested because of the complexity of the system. If the work were started at the intake, the dirt which was loosened would be carried by the fans into the public spaces. If commenced at the discharge end, dirt laden air would continue to blow over the cleaned surfaces of the ducts. Action was necessary, however, since the "house" was becoming busier daily.

Over the years, the ventilating system was operated like any other. Fans were started when required and shut down promptly. Worn spray nozzles were replaced in the air washers. However, all systems may be advantageously cleaned and rejuvenated after being run continuously for 20 years. Confronted by a backlog of past operating difficulties, certain selfevident improvements become apparent.

The air supply, 1,000,000 cfm, comes in at the roof of the service building, a 19-story structure adjacent to the hotel. This roof presented an ideal location for the erection of a metal housing enclosing an intake filter frame. Standard dry units were selected. During the initial planning, too much consideration was given the guarantee of filter efficiency, rather than the nature of the medium that imprisons the dust particles and prevents their escape into the air stream—namely, the oil. All of these things entered into the final design. There was a spread in the operating efficiency, between 80 and 50 per cent, with the "micron sized fines," which do so much of the dirty work, blithely sifting through. Accessibility for filter removal was obtained by the use of a swing stage. Thirty days is the lapse between cleaning periods and 3 ounces the average collection per filter during that time.

From the roof, the air, impelled by the suction of the fans, drops

The "world's greatest" hotel



Chief Toombs calls the duct system "the world's greatest galvanized wonder"

vertically through a large shaft. It descends perpendicularly nineteen floors and on down through three sub-basements, 250 ft in all. The shaft is constructed of rough tile and brick, interspersed with reinforced concrete beams. The edge of each beam protrudes from the face of the shaft and there collects a pile of dirt, which gradually builds up until over-balanced. Then, suddenly it topples into the shaft and is carried along in the ever-increasing velocity of the incoming air stream. The exposed rough edges of the tile, as well as each projecting point, serve only to accumulate dust.

Tile and Brick Air Shaft

To prepare for the cleaning of this tile shaft, a generous sized access door was broken through the face of it at every third floor. Openings were framed with steel angles, plastered, and a plate front was cap screwed over a felt gasket. Two 1½ in. fire hoses, under full pressure, poured a solid wall of water down the face of the shaft, rapidly washing away the dirt, dust, and grime from the projections. Starting at the roof level, the procedure was continued to the basement. No hand scrubbing was necessary, since the face of the tile wall was thoroughly scoured by the impact of the water. The secret is "use plenty of water under pressure." After initial preparations, the job progressed quickly. The entire shaft was cleaned in two days by two men, a surprisingly quick and cheap method. The horizontal run to the indirect heating coils was treated in like manner. Ground water seepage leaks were stopped, sewers rodded out, and all surfaces given a coat of special waterproof paint.

Cleaning the Heating Surface

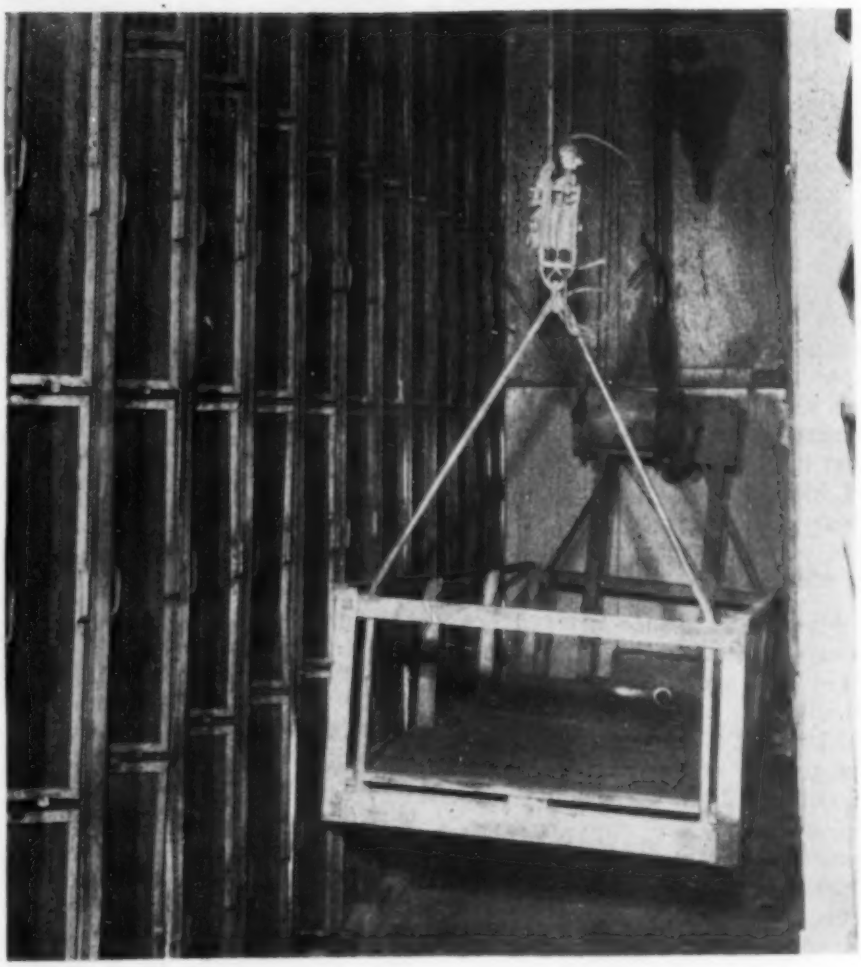
The cast iron indirect heating surface presented an entirely different cleaning problem. Rust in the form of scale, flecked from the surface of the coils, was carried along in the air stream. Supply air was recirculated, using all of the exhaust possible and the main supply reduced to a minimum. Special tools were devised—a hook with just the clearance between coils, a long piece of aluminum tubing, flattened on one end and connected to the house vacuum system, together with a large supply of long handled wire flue brushes. At the rear of the section being cleaned, a frame was erected and covered with a double layer of cheese cloth. This served as a trap for the larger pieces of scale when they were dislodged from the surface of the coil.

This stage of the cleaning progressed rather slowly until it was found that a barricade made from canvas could be used as a protection, diverting the incoming cold air away from the workmen. This simple device saved many head colds and consequent absenteeism.

Accumulations of dirt on top of the steam lines were removed with a vacuum brush, then hosed down. Insulation and broken pipe bands were patched or renewed. The heaters were thoroughly washed with the fire hose, which removed the remaining traces of dust left from the vacuum cleaning. A special paint, with no penetrating odor, was sprayed on the heaters. Fifteen sections were permitted to dry, with a lapse of two days before being put into service. A low heat baked out the paint. Practically no complaints from paint odors were forthcoming.

The Main Air Washer

The main air washer, which has a 100 ft face, was next for its share of attention. Pumps were over-



The main filter bank on roof of the service building, showing swing stage for use in removing the filter cells

hauled. Vertical spray risers of 1½ in. brass pipe were taken out, 15 at a time. The header was plugged. All sprays were removed and the brass pipe treated to a detergent bath by submerging in a solution of ⅔ inhibited acid and ⅓ water. The acid thoroughly scoured the internal surface of the pipe as well as the exterior, bringing both right down to the clean metal. The acid was quite cheap and later found many more uses in the plant.

Two thousand eliminator plates were in deplorable condition. Having no priority for metal, redwood was used. Several trial designs were assembled. The style adopted has a sharp leading edge, and the leaving edge is designed to propel the streams of air in a direction where previously there had been a noticeable absence of sufficient air supply when certain combinations of fans were running together. The louver strips were spaced as far apart as possible so as to present the largest free air area, thereby improving upon the previous restriction to the air flow. These eliminator plates are prefabricated in the shop, then installed.

That portion of the plenum chamber beyond the air washer is a checkerboard system of steam, water, and air lines. Main exhaust ducts pass through the chamber, obstructing air flow. The cleaning of this area was the same method as previously employed—thoroughly swept down, tops of pipes vacuumed, fire hoses, rotary floor scrubbing machine, a final wash, then squeegeed, and when dry, painting with the waterproof paint. Foundation cracks were cut out and sealed from moisture. Service lines were coded by color and the whole area re-lamped. It certainly looked clean; no trash, no loose boards, no old brooms—a decided improvement. Bumped heads and stiff necks were common casualties among the workmen.

[Mr. Toombs will complete his story of this big cleaning project in a second article.—Ed.]

A MAJOR task in the rehabilitation of the big Stevens hotel was the cleaning of some 15 miles of supply and exhaust ducts, the plenum chambers, the indirect heating surface, and other parts of the heating, air conditioning, and ventilating installations. How the work was done is described here, and Mr. Toombs gives many practical suggestions for facilitating such a job. . . . As a result of this experience, he concludes that there should be a good market for the sale of complete duct cleaning equipment, that access doors are required in all systems and should be incorporated in the original installation, that a portable vacuum system, and a small, high pressure, portable air compressor are necessary for major cleaning operations, that air supply grilles with external damper control are necessities for public rooms, that an annual cleaning and freshening up is required for each system, and that the use of large plenum air supply chambers is better, from the cleaning standpoint, than smaller individual systems.

The Author

It's a Busy Life . . . Keeping a Refrigeration System in Operation

PROPER OPERATION and maintenance of a refrigeration system of medium or large size consists of a great many "acts" by the operating personnel. Some of these acts are more important than others. Some are so unimportant that if discontinued, they would not affect the operation of the plant at all. Others, however, are so important that the plant could not operate at all without them. In many plants there is no hard and fast dividing line between important and unimportant acts.

Since maintenance acts cannot always be distinguished from operation acts, and since both are frequently carried out by the same workman, the duties about a refrigeration system may be better classified as continuous acts, routine acts, irregular or emergency acts, and planned acts. Where clearcut division of work is possible, as in plants requiring a large personnel, continuous and short-term routine acts generally fall to the operator, while irregular and long-term acts fall to the lot of the maintenance engineer, or crew. Extensive planned acts generally are carried out by a contractor, erecting engineer, or the maintenance man or crew.

Since the term "routine" describes such a great variety and multitude of acts by plant personnel, it is best understood by breaking it up into time schedules. Therefore all duties about a refrigeration system may be tabulated as follows:

1. Continuous acts.
2. Hourly acts.
3. Shift change acts.
4. Daily acts.
5. Weekly acts.
6. Monthly acts.
7. Seasonal acts.
8. Yearly acts.
9. Irregular or emergency acts.
10. Planned acts.

In many plants continuous and short-term routine acts are indistinguishable. This is also true of seasonal and yearly acts. And jobs which are done on a weekly schedule in one plant may be carried out on a monthly schedule at another.

Continuous Acts — First and foremost, if not the most important, of the duties of the operating engineer are those numerous and hardly definable little acts which take up the greater part of his time. For the alert engineer, these acts begin when he gets within sight or earshot of his plant. And until he turns his back to the plant at the end of the day or shift, his eyes watch gages, meters, indicators, and even hunt for such things as a belt out of alignment or the frost line on vapor pipes.

The alert operator also makes use of his other senses. Consciously or subconsciously, he listens diligently to the pulsations of reciprocating machines, to the click of an uneven belt passing over a pulley, and to any other sounds peculiar to operation of the plant. He uses his sense of feeling to keep a check on bearing and cylinder wall temperatures. In a system charged with ammonia, he frequently uses his sense of smell in the detection of leaks.

Hourly Acts—In many plants there is an hourly, multi-hourly, or fractional hourly check of temperatures in brine tanks, brine coolers, condensers, cold storage compartments, etc. In smaller plants this duty falls to the operating engineer. Indeed, it is mandatory in many cases that he make the readings himself.

Many operators also "make the rounds" of the machinery at hourly, half-hourly, or quarter-hourly intervals. This duty usually consists of an inspection tour. Bearings are felt for excess heat, adjustments of valves and other controls are made, thermometers are read, and bearing peephole covers are raised to see that oil rings are turning.

Shift Change Acts—The engineer going off duty should make a more thorough inspection tour, and leave to the relieving engineer written notes of any variations from normal procedure during the shift running out. In some plants machines are operated on one shift, but not on another.

Daily Acts—Each day in every plant there is a more or less regular routine followed by the plant personnel. In many plants the daily acts of the workers are the only ones which can properly be called a true routine.

Weekly Acts—The weekly routine is very frequently of a preventive nature. Motors are "blown;" slip-rings and commutators sanded; switches and contactors are cleaned of burned spots; oil is blown down; oil is added to enclosed crankcases, and so on.

Monthly Acts—The monthly routine is much the same as the weekly, and may be alternated in the same plant. Plates are removed from enclosed bearings for inspection. And hot vapor defrosting of evaporators is carried out usually not oftener than once monthly.

Seasonal Acts — Seasonal acts may be such as putting a second condenser into service and cutting it out of service, as the case may

By George Holman
Operating Engineer

HERE'S ANOTHER of George Holman's word-and-picture stories on operation and maintenance of refrigeration piping and equipment. He reviews the many "acts" necessary in keeping a system in good operating order. . . . With continuing wartime demands, with much equipment and manpower not available or hard to get, and with busy postwar days somewhere ahead, it is essential to keep all mechanical installations in the best possible condition

be. The same may be said of other plant equipment, as the seasonal load ebbs or flows.

Yearly Acts—This is essentially a general checkup and overhaul of all equipment in the plant.

Irregular or Emergency Acts—Everything out of the ordinary, or even in the ordinary, if it is not routine, may be classed as emergency or irregular. A small leak of the refrigerant is just as much an emergency as a broken compressor crankshaft.

Planned Acts—These are in the nature of alteration of old equipment or the acquisition of new. Usually the work is carried out by contract, with much of it being done by workers not of the plant personnel.

Another Classification

From the operator's standpoint, there is yet another method of classifying the work required to keep a refrigeration system in peak operating condition. This method is simply a division of work into two parts, jobs which can be done without opening the system with wrenches and jobs which require such an opening. In the plant shown in the photographs there are almost as many jobs requiring opening of the system as need be done on auxiliary equipment.

Fig. 1—Suction and Discharge Pressure Gages: The pressure gages require and obtain the operating engineer's constant attention. These are the most important instruments in most plants. Sometimes they are the only instruments. They indicate to the skilled operator just how well or poorly his plant is operating. Should one or both of these gages vary from normal, the operator knows why, and if necessary makes proper adjustments.

For example, if the suction gage should fall from the 20 psi shown, the operator would expect it to be caused by one or more of the following conditions:

1) Expansion valves closed too much.

2) Agitator or brine circulating pump of an indirect expansion system stopped, throttled, or otherwise slowed down.

3) Circulating fan of a direct expansion system evaporator stopped, slowed, or otherwise not working properly.

4) Too much frost collecting on the evaporator.

5) Falling head pressure (noticeable on right hand gage), which would force less liquid through expansion valves with constant settings.

6) Serious leak from the low pressure side of the system. Unless this leak were into brine or water, or some other fluid, it would be noticed before the gage pressure had fallen far.

7) Closed or throttled valve in the liquid line between the condenser and/or receiver and the evaporator, thus not allowing enough liquid refrigerant into the evaporator to maintain the pressure. A clogged strainer might also be the cause.

8) Increased speed of the compressor, or increased volume of vapor pumped by a variable volume compressor.

If the suction pressure should rise, the cause would likely be one of the following:

1) Partly closed suction valve at the compressor manifold.

2) Poppet or feather type suction valve sticking open or closed.

3) Poppet type discharge valve sticking open. If there is more than one discharge valve, as is usually the case with vertical compressors of large displacement, one or more discharge valves may stick closed, and impair the capacity. Otherwise, this is not possible with an operating compressor.

4) Expansion valves opened more widely.

5) Increased load with evaporators fed by thermal expansion valves.

6) Increased velocity of air, water, or brine flowing over the evaporators.

7) Clogged strainer in suction manifold of compressor.

8) Decreased speed of the compressor, or decrease in volume of vapor pumped by a variable capacity compressor.

Should the pressure indicated by the discharge gage fall, one or more of the following causes would be indicated:

1) Less vapor being pumped from the low pressure side of the system by slowing the compressor, limiting its capacity, etc.

2) More or colder water passing through the condenser.

3) Machine valves sticking open, with less vapor being discharged, as given in point 1.

4) Falling suction pressure due to any cause.

Should the pressure indicated by the discharge gage rise, one or more of the following causes would be indicated:

1) Condensing water has decreased in volume, or its temperature has increased.

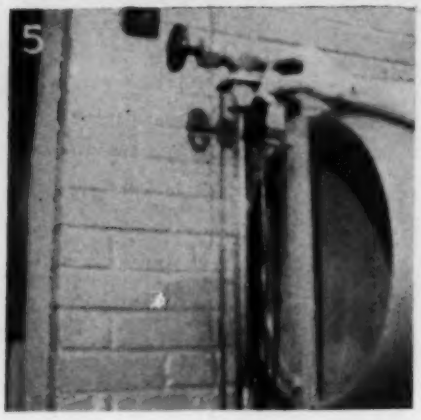
2) Suction pressure has risen, due to any cause.

3) Compressor is delivering more vapor to the condenser, whatever the reason.

4) Compressor vapor is warmer, whatever the reason.

Fig. 2—Making the Rounds: Routine inspection at hourly, multihourly, or fractional-hourly intervals intercepts trouble before it occurs. Here the operator inspects the outboard bearing of an enclosed crankcase compressor.

Fig. 3—Expanding Back: Frost forming on the compressor manifolds shows that very cold vapor, and possibly some liquid of the refrigerant is entering the compressors. With poppet type valves, this "expanding back" dampens the compressor pulsations, and operation becomes much quieter. This condition is "borderline," however,



and compressors so operating require stricter attention from the operator. If too much liquid enters the compressors, the safety heads may pound when the incompressible liquid is caught in the clearance space.

Fig. 4—Testing for Ammonia Leaks: Ammonia has a strong, pungent odor, but the source of it in the air of a plant is sometimes hard to determine. One of the methods of finding a leak is by burning a sulphur-coated taper near the suspected place. The leak is revealed by formation of a white, easily visible smoke.

Fig. 5—Testing for Ammonia Leaks: A second method of locating an ammonia leak is by use of standard test paper, which when wetted and held near a leak turns a bright red, if phenolphthalein, or deep blue, if litmus is the indicator used in the paper.

Fig. 6—Blowing Dust and Lint Out of Motors: A part of the weekly routine of any electric motor driven plant should be the removal of dust, lint, etc., from the motor windings by blowing.

Fig. 7—Sanding Sliprings: Slip-rings of a-c motors and commutators of d-c motors may become blackened and/or dirty, and spark excessively, especially when starting. A piece of single O or double O sandpaper will quickly clean the surfaces. Operator or electrician must stand on insulated mat when sanding d-c motor commutators.

Fig. 8—Cleaning Switches and Contactors: In the electric driven plant cleaning all electric contact points should be on the weekly routine.

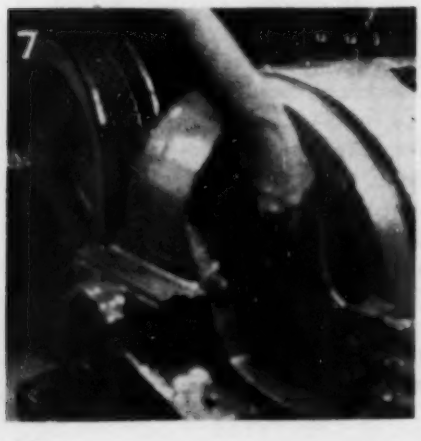
Fig. 9—Charging Oil Into a Compressor Crankcase: All compressors "pump oil." This lowers the level of the oil in the crankcase, and new oil must be added. With the compressor running, the suction valve is closed, and the end of the oil charging hose is submerged in the oil to be charged. As soon as a vacuum is pumped in the crankcase, the charging valve is opened, and atmospheric pressure forces oil from the can through the hose and valve into the crankcase. There is neither crankcase pumpout valve nor pressure gage on the crankcase of this compressor. Therefore, the presence of a vacuum in the crankcase must be determined by opening the charging valve slightly. If bubbles, dark oil, or the smell of ammonia appears, crankcase still is under pressure.

Fig. 10—Blowing Down Carry-over Oil: For every gallon of oil put into the compressor crankcase, a gallon of oil must be removed from the system at one or more of various oil blowdown outlets. Oil from an ammonia system is best blown into a bucket containing cold water. If the area containing the accumulation of oil can be isolated from the rest of the system, the blowdown procedure is much safer. However, it is not at all unusual for operators to blow down oil from the high pressure side of a system in operation, as shown. Here the operator keeps both hands on the blowdown valve wheel as the oil collects in the bucket.

Fig. 11—Defrosting of Direct Expansion Evaporators: Whenever frost begins to close the space between pipes, a defrost of direct expansion evaporators becomes mandatory.

Fig. 12—Testing Concentration and pH Value of Brine: Keeping the brine in proper condition is a routine task best carried out at weekly intervals in the smaller plants.

Fig. 13—Stethoscope: With a piece of hardwood between his teeth and held against the head, the operator listens in on compressor performance.



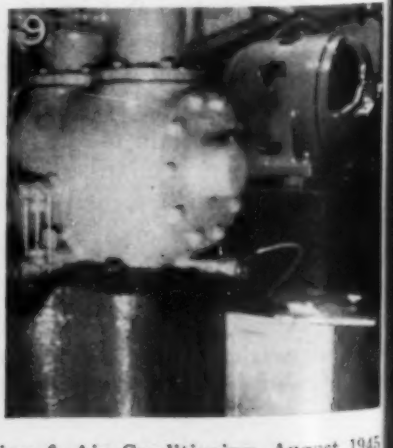


Fig. 14—"Feeling for" Leaky Compressor Machine or Manifold Valves: If a compressor discharges into the same hot gas line with other compressors, sticking or poorly seating valves are indicated by the discharge line remaining warm during the off cycle. If this line is still warm an hour after the compressor stops, there is some likelihood that the valves are leaking.

Fig. 15—Pressure Check for Valve Leakage: To verify the above point, close the return valve. If line to suction gage taps into the suction line between the return valve and the manifold suction valve, as it should, leaking valves would cause a rapid suction pressure rise.

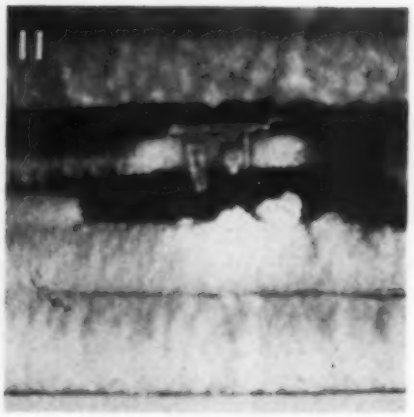
Fig. 16—Frost Meltage as Leakage Indicator: When frost falls off evaporator coils during the off cycle, it may be regarded as a sure sign that the compressor valves are leaking.

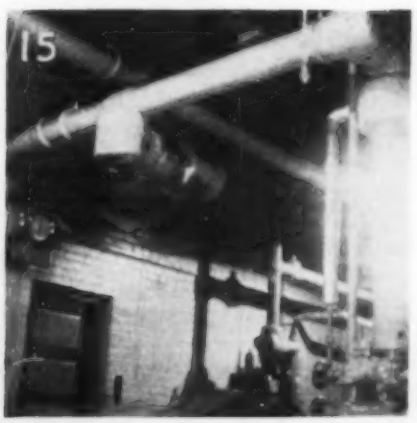
Fig. 17—Pressure Setting for Oil Pump: Shaft-end oil pumps require a pressure setting of 5 psi to 15 psi above the suction pressure. Here the setting is 35 psi gage, while the suction pressure shown in Fig. 1 is 20 psi. If oil pressure is too low, shaft bearings and packing may not get oil. If the setting is too high, the compressor "pumps oil."

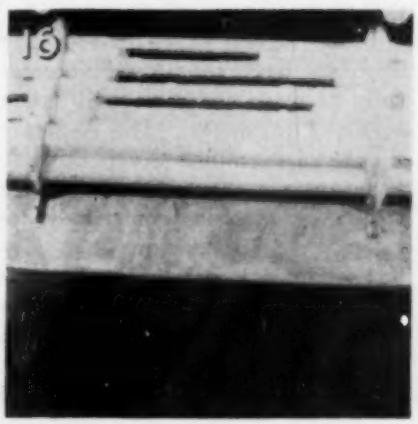
Fig. 18 — Temperature-Pressure Comparison for Wet Compression: No matter what its temperature when returning from the evaporators, the vapor of a refrigerant is always heated by compression. The temperature to which it is heated depends upon such things as the speed of compression, the quantity and temperature of the jacket cooling water, suction and discharge pressures (compression ratio), amount of friction in the cylinders, and—above all—upon the initial temperature and presence of liquid refrigerant.

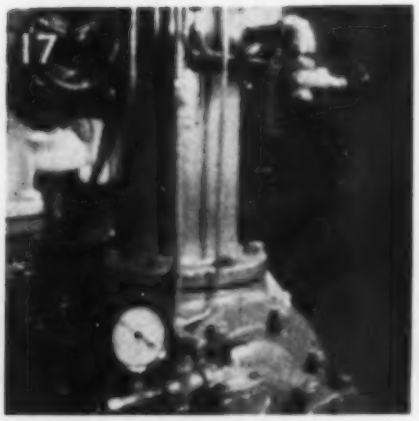
If liquid is present in the vapor, frost will usually form on the suction manifold. Compression is then said to be "wet." In high speed compressors, the presence of much liquid is dangerous, due to its incompressibility and to the small clearance space between the pistons and the safety heads.

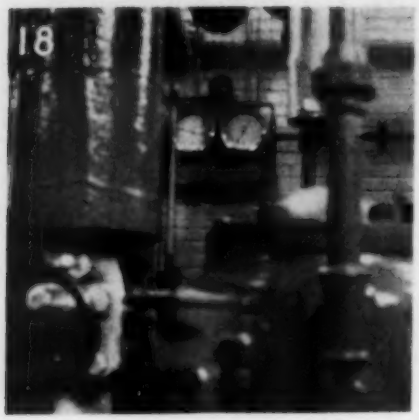
If the refrigerant is ammonia,











wet compression is normally safe if the temperature of the discharge vapor, as determined from a thermometer set into a well in the discharge manifold, is higher than the pressure indicated by the discharge gage.

CONSTRUCTION ACTIVITY GAINS SUBSTANTIALLY

Marked by a pronounced recovery in privately owned manufacturing building, construction activity in the 37 states east of the Rocky Mountains showed substantial gains in the first half of the year, it was reported last month by the F. W. Dodge Corp. All major classifications of construction showed gains over the first half of last year except residential building, which was down slightly more than 3 per cent.

The total of all construction contracts awarded in those states during the first six months was $1,482,399,000 compared with $960,-221,000 in the corresponding period of last year, a gain of 54 per cent, the Dodge corporation reported.

Nonresidential construction showed an increase of 106 per cent. Public works and utilities increased 31 per cent. Manufacturing building construction contracts gained 162 per cent over last year.

STUDY WATER-GAS PROCESS

Under the sponsorship of the American Gas Association, research engineers at Battelle Memorial Institute have set out to determine what goes on in a water-gas generator. For more than 60 years, gas has been made from steam and coal or coke by the water-gas process, and, for just as long, the exact method by which the gas is formed has been a matter for discussion and speculation.

As explained by Ralph Sherman, supervisor of fuels research at Battelle, a greatly increased demand for manufactured gas for heating is expected after the war. To meet this demand, the gas industry faces a great expansion in production. Processes and plants of large output and low capital cost are required, because the full capacity is needed but a few days per year. A more complete knowledge of the mechanism of the water-gas reaction may permit changes in design or operation that will obtain from the highly reliable water-gas set more gas at lower cost.

Availability of cheap oxygen in the postwar period may make it economical to mix oxygen with the steam to produce more gas without increase in the size of the generator. Gasification under high pressures should make it possible to reduce the size and cost of the gas-making equipment. The effect of such modifications on the mechanism of the combination of carbon and steam will be investigated as part of the research.

This investigation is part of the million dollar research program being conducted by the manufactured gas production research committee of the AGA to assure the availability of manufactured gas at low cost for all requirements after the war.

Battelle Memorial Institute, in whose fuels laboratories the experimental study is already in progress, is an endowed foundation for education and industrial research. It conducts research in fuels, metallurgy, chemistry, physics, ceramics, and other physical and engineering sciences.

Preventing Airbinding of Steam Traps

By L. W. Mauger, Supervising Engineer
Brown, Wheelock, Harris, Stevens, Inc.

In some instances and with certain float traps without thermostatic bypasses there is a tendency for the traps to become airbound. We ordinarily overcome this by having the top of the trap body drilled and tapped for ¼ in. pipe connection at the factory. A ¼ in. nipple about 12 in. long is screwed into the tapping and a straight shank vacuum air valve is set on top. The air is released through the air valve when steam is on with more than atmospheric pressure, but the vacuum is not broken when the pressure drops below atmosphere. Instead of the air valve, the relief line may be tapped back into the riser so that the air may pass up the riser with the steam.

Float valves with thermostatic elements have been used successfully as main and riser drip traps in many instances. The elements should be examined every summer to be certain they are not passing steam. Difficulties sometimes develop when the vacuum in a system, due to condensation after steam is turned off, exceeds the vacuum in the returns, or when drips from more than one zone are discharged into a common line, and these zones may be turned on and off at different times. Float and thermostatic traps discharging into a dry line should have an atmospheric vent so that air may be discharged before the line becomes wet. This line should tie in to the outlet side of the vacuum pump whenever pressure and head permits.

Thermostatic drip elements discharging into the vacuum receiver are often the cause of excessive temperatures, and there is a tendency for the condensate from the drips to flash into steam and thus reduce the vacuum.

Sam Lewis' Page

A CASE OF GOOD HOUSEKEEPING

I MOVED last December to new offices on the 21st floor of the 22-story building at the northwest corner of West Monroe and South Clark Sts., Chicago. Part of this building occupies air rights over a historic cow path, dedicated in perpetuity a hundred years ago for the unobstructed passage of the lowing herd. This may be one of the earliest buildings to use air rights, a scheme so popular in New York—and in Chicago, where it is exemplified especially by the Merchandise Mart and the Daily News building.

The 100 West Monroe building is of standard steel frame and masonry construction, with metal window frames, single glass, and a downfeed steam vacuum system. There is copious mechanical ventilation of several stories. My offices, on the west exposure of this tall building, catch the north, south, and west winds, yet were comfortably heated in the coldest weather.

There are three manually fired steel boilers in the basement, together with the conventional electric vacuum pumps, electric house pumps, fire pump, coal burning hot water heater for summer, mechanical refrigerating plant for the restaurant, etc. Since the boilers are hand fired there is no automatic control of the combustion rate responding to steam pressure in the boilers.

You Can Read the Nameplates

Any one visiting the boiler room and machine rooms will, however, be impressed by the clean condition of everything. There are no old tobacco cans or broken down chairs on top of the machinery and there is no evidence of a junk pile. The brass trimmings of the valves are all shining and polished. All nameplates on machines—such as pumps and motors and fans—can be read without hunting up a rag to wipe them. An inspector does not need to take a bath on leaving the basement.

All of the surfaces of piping insulation, boiler fronts, etc., exposed to view are painted and are clean. The insulation has been sealed vaportight and all of it is painted. There are no piles of dust on the tops of the various pipes. Apparently the whole boiler room equipment receives a frequent scrubbing.

I opened the manhole doors at the inlets of the ventilating fans. The interiors of these ducts and air passages were as clean as was the outside of the ducts, a most unusual situation, as will be verified by any one who inspects many old ventilating systems. There was no oil spilling over, such as one sees from carelessly maintained bearings in airways, and there was no oily dust in the ducts nor in the vicinity of the fans and their bearings. This is the result of routine housekeeping and is not due to spasmodic housecleaning.

The original steel boiler flues and grates are still in service. All the valves and vacuum trap diaphragms have been maintained. Instead of resting in easy chairs all summer the crew opens up the valves and tests them and replaces them where necessary.

All of these observations awakened my interest in the quality of the engineer responsible for them and occasioned an investigation of the fuel and maintenance records. The building is nearly 20 years old. As is usual with the first season's coal consumption in a new building, 1191 tons of coal were burned in 1929. Following this, the annual tonnage receded gradually, while giving full satisfaction to the tenants, until in 1939 but 590 tons of coal were required. Since 1939 the average coal consumption remains in the 600 ton zone.

IN THIS regular feature, informal comment on heating, piping, and air conditioning problems is given by Samuel R. Lewis, consulting mechanical engineer, and a member of HPAC'S board of consulting and contributing editors. This month, Mr. Lewis plays the satisfied tenant, and reports on the condition of the ventilating and the heating equipment in the building to which he recently moved his offices. He found in the boiler room that the brass trimmings of the valves were shining and polished, and that he could read the nameplates on the pumps, motors, and fans. The coal consumption is about 45 lb per equivalent square foot of radiation per heating season.

45 Lb of Coal per Sq Ft per Season

The connected load is 27,000 equivalent square feet of radiation, giving an average of about 45 lb of coal per season per square foot. A frequently used estimate for coal consumption per square foot of steam radiation per season is 80 lb. To heat a tall office building having four side exposure on 45 lb of coal per equivalent square foot of radiation is in my judgment doing very well indeed.

I see so many unspeakably dirty mechanical plants and hear so many complaints of slovenly housekeeping and maintenance that the experience with this building and its engineer, Joseph Sassetti, is most refreshing. I see so many corroded out pipes, so many leaking valves, and so many dollars spent for repairs and replacements that I must comment favorably on the administration of this building.

Apparently the advice of the operating engineer is given some weight in the requisitioning and purchasing of maintenance items.

* * * *

YOU ARE INVITED to throw bricks or bouquets at the editor. Your comments on articles published in HPAC —or subjects you believe we are neglecting — will certainly be appreciated, and will be helpful in planning future issues. What do you like this month? What don't you like?

• WPB . . . OPA . . . PAW . . . Etc. •

Controls Again on Oil Burners

Continued tightness of fuel oil supply has necessitated reestablishment of control over the sale and installation of oil burning equipment, WPB has announced. This action is taken by order L-349, issued recently by WPB upon recommendation of the Petroleum Administration for War. The order prohibits the sale or installation of "oil burning equipment designed to burn fuel oil for furnishing heat" except (1) to replace such equipment that is worn out, damaged beyond repair or destroyed; or (2) where the use of oil for a particular installation has been approved either by PAW or the OPA, depending on which agency has jurisdiction over the use of the fuel oil for that installation.

Manufacturing and distribution controls over oil burners were removed through revocation of order L-74 on May 11, 1945. However, restrictions on the use of fuel oil remain in force, because high military demands have limited the quantity available for civilian consumption, PAW pointed out. As a result, a person might have an oil burner installed and then be unable to obtain oil rationing coupons from OPA.

Oil burning equipment covered by order L-349 includes the following types: mechanical, steam or air atomizer; vertical or horizontal rotary; mechanical vaporizing; and pot type and sleeve type vaporizing oil burners. It includes oil burners for boiler or furnace burner units, burners used as parts of water heaters, and any combination oil and gas burners.

More Copper Wire for Repairmen

The amount of copper wire that repairmen may buy in a calendar quarter without WPB authorization has been increased from $75 worth or one-tenth of what they used for repair in 1941 (whichever is greater), to $150 worth or one-eighth of 1941 repair usage, WPB announced recently in an amendment to CMP regulation 9A (parts and materials for repairmen).

Direction 2 to this regulation now provides that a repairman may use up to only $25 of the material purchased under the regulation to install any unit of new or used air conditioning or refrigeration equipment. The direction formerly limited material for installation of used air conditioning or refrigeration equipment only.

Higher Ratings for Vets Administration

The Veterans Administration has been placed on an equal basis with the military in the matter of preference ratings, the WPB announced recently.

Under former orders the administration had an AA-3 rating on its hospital construction program, which extends through 1946, with the privilege of uprating 7½ per cent of this to AA-1 in the case of bottleneck items. It also had an AA-1 rating for maintenance, repair, and operation under the Controlled Materials plan, but was otherwise unrated except by special application to WPB.

Under the revised directive (39) the Veterans Administration is permitted to assign preference ratings, including the MM (military) rating, to all of its procurement, including materials for maintenance, repair, and operating supplies for its establishments. Provision is also made for WPB assistance to the administration in obtaining productive capital equipment and machine tools for its own use or for its contractors where the emergency is great and the equipment cannot be obtained in the open market.

Sellers May Charge Line Pipe Price

Resellers of pipe who furnish threaded and coupled line pipe 8 in. and larger to fill orders for merchant pipe may charge the line pipe price which is higher than the price of merchant pipe, the OPA announced recently.

This announcement was made to clarify pricing for resellers of pipe, many of whom are now unable to obtain 8, 10, and 12 in. threaded and coupled merchant pipe that they ordered and are having to accept threaded and coupled line pipe in the same sizes. The line pipe price may not be charged, however, unless the pipe offered for sale meets line pipe specifications.

Fuel Oil Ration Order Amended

AMENDMENT 61, EFFECTIVE JULY 13

Revised ration order 11 has been amended by the OPA to clear up the interpretation of "necessary living and sleeping quarters." According to the OPA, the quoted phrase has been interpreted as a test of the applicant's eligibility for a fuel oil ration for heating. Thus, whether the premises had any "necessary living and sleeping quarters" depended upon whether it was necessary for the occupant to live on the premises. As a result some local ration boards, for example, denied applications for rations for summer homes upon the ground that the occupancy was unnecessary. The amendment provides that the quoted phrase does not limit an applicant's eligibility for a ration, but only limits the space that may be counted in computing the ration.

AMENDMENT 62, EFFECTIVE AUGUST 7

1. *Previous Regulation*—Generally, a person who has first possession of fuel oil within the rationed area is required to register as a primary supplier within five days.

Change and Reason for Change—Many persons have been required to register as, and remain, primary suppliers even though they made a single or very few importations of small quantities of fuel oil. This amendment is designed to avoid the labor involved in preparation and processing of monthly reports from such persons, without impairing effective rationing control of the fuel oil imported from without the rationed area.

2. For the purpose of clarity there is added to the regulations a specific prohibition against the detachment by a dealer or primary supplier of a coupon from a consumer's coupon sheet before the date on which the coupon becomes valid for a transfer of fuel oil.

AMENDMENT 63, EFFECTIVE AUGUST 1

Previous Regulation—A fuel oil ration may not be

issued or used for surfacing or maintaining roads or as a dust palliative or for the manufacture of a paving product of dust palliative.

Change—To permit the issuance of fuel oil rations for these purposes upon presentation of an authorization from the PAW.

Reason for Change—Amendment 60 to revised ration order 11 revoked the pre-existing provisions for the issuance of rations for slow curing road oil for use as, and manufacture of, paving materials. Meanwhile, some roads had been scarified and otherwise prepared for surfacing. The change will make possible the completion of the work on these roads and the manufacture of certain necessary paving products. This has the concurrence of the PAW.

Valves and Fittings for Destroyer-Escort Program

The scheduling of orders for valves and pipe fittings intended for installation in the naval destroyer-escort construction program is no longer required, the WPB said last month.

The removal of this requirement was effected by the revocation of direction 1 to table 11, to the general scheduling order (M-293). WPB officials explained that since the urgency of the destroyer-escort program has long since passed, the direction requiring special rescheduling for valves and pipe fittings was no longer required.

Heavy Backlogs, Military Requirements, Slow Deliveries, Says WPB

Heavy backlogs of unfilled orders and continuing military requirements are slowing up the free flow to civilian users of the majority of the products controlled by the general industrial division of the War Production Board, WPB said August 2.

With months of unfilled orders on their books and, in some cases, manpower still short, producers are working to bring requirements and supply into balance.

WPB controls over the majority of the industries have been reduced to overall WPB orders and regulations. The industries are on their own and are being urged by WPB to make every reasonable effort to find the answer to their own problems except where materials and components are required for military production and where emergency circumstances arise.

To acquaint industry and the public as to the general supply and demand situation as it applies to general industrial equipment, the division has prepared summaries of some of the various types of production coming within its field of action.

Electrical Motor and Control Equipment

The delivery situation of integral and fractional horsepower motors, motor generators and control equipment has shown little or no improvement over the last few months, in spite of heavy cancellations, terminations and cutbacks in military programs, WPB said.

Indications are that little improvement can be expected during the third quarter because of heavy and high-rated backlogs of orders on the manufacturers' books, and because of the critical supply situation on such components as electrical sheet, cotton insulating tape, gray iron castings, etc. Net new orders during May and June continued to exceed production of general purpose alternating current integral horsepower motors 50 hp and smaller, general purpose fractional horsepower motors, and single phase integral horsepower motors.

Some improvement can be expected during the last quarter of this year and the first quarter of next year. Under proposed operating procedures for fourth and subsequent quarters, as covered by priority regulations 29 and 30, it is expected that a substantial percentage of current backlogs will not be validated and will automatically revert to an unrated basis.

In spite of announced cutbacks in military programs, the requirements of electrical equipment for top military programs are still heavy, with additional requirements for quick delivery confronting the industry daily. Changes in one program are generally being offset by increases in another. An outstanding example is the Navy spare parts and fleet maintenance program, which is being put into operation and which offsets to a marked degree reductions in production requirements for new ship construction.

Refrigeration and Air Conditioning

Shipments of commercial and air conditioning refrigtion machinery continue heavy for the armed forces for the third quarter, particularly in food handling equipment for the advance bases in the mid-Pacific. The removal of various limitation and material orders, which have controlled the production and distribution of refrigeration machinery, has released a pent-up demand for this type of equipment.

Some concern is felt by certain groups of the refrigeration industry that, as a result of a shortage of components such as fractional horsepower motors, fin and tube condensers, and compressor body castings for complete assembly, the present backlog of rated orders will become unmanageable, a hardship will be created and a delay will occur in the reconversion program. The division feels, however, that by the fourth quarter, controlled material and components will have relaxed enough to warrant an initial flow of refrigeration equipment to civilian consumers, even to the extent of unrated orders by the last of this year. It is expected that, during the transition period, an occasional hardship case will occur in this industry and that, despite the general policy of WPB not to give priority assistance to civilian production, in a very few exceptional cases it will be necessary to help out on the production of certain refrigeration and air conditioning items.

Reciprocating Air and Gas Compressors and Dry Vacuum Pumps

The backlog of orders has averaged $66,000,000 since January 1944, with a backlog of $72,000,000 as of June 1, 1945.

Cutbacks in the last few months have not resulted in a drop in unfilled orders. Unrated orders are now being placed, and on some types of compressors comparatively prompt deliveries are being made. Contemplated cutbacks by the military will result in open capacity, which will be taken up by unrated orders. Most manufacturers have plenty of facilities and

capacity, and could improve their deliveries with more manpower, according to WPB.

Fans and Blowers

The present backlog of orders for fans and blowers amounts to approximately $41,000,000 which is 76 per cent of the backlog of the industry at the end of January 1945, and about 46½ per cent of the backlog for the month of June 1944.

The figures represent the backlog of rated orders only, although there may have been some unrated business included. This unrated business, however, would not affect the figures more than 1 per cent, WPB said.

There are no data available on the amount of unrated orders actually booked, but this can be estimated at about 5 per cent of the total backlog or approximately $2,000,000.

There is not too much capacity available at the present time for unrated business. There is also the factor of material. It is estimated that in one month or six weeks there will be a decided change in this, and that by early September there should be plenty of available capacity for unrated business. There is no difficulty at the present time in meeting military requirements.

High Pressure Fans and Blowers

The present backlog for high pressure fans and blowers amounts to approximately $15,000,000. This is 110 per cent of the backlog in January 1945, and is approximately 87 per cent of the backlog in June 1944. These figures represent rated business only.

There are no definite figures on the backlog of unrated orders, but it is estimated that this would not exceed $800,000, which would be approximately 5 per cent of the total backlog.

This industry is still heavily burdened with military orders, and very little unrated business is being handled. Because of the special nature of some of the products, no improvement in production for unrated business is expected until November or December.

Dust Collectors

There are no statistics available on dust collector production, mainly because this is not an M-239 (general scheduling order) item, and no schedules have been received. Certain types of dust collectors, such as electrical precipitators, are still relatively tight, as these are required on various chemical projects that are connected directly with the war effort. All other types of dust collectors, however, are relatively free and there is plenty of available capacity for the production of unrated orders, WPB said.

Pumps—Industrial

Present backlog is $220,000,000. This is approximately 83 per cent of the backlog six months ago, and 72 per cent of the backlog 12 months ago.

Present backlog contains approximately 5 per cent unrated orders, with shipments a fraction of 1 per cent.

At the present shipping rate of $31,000,000 per month, it will be at least seven to eight months before shipments of unrated orders can be made in any appreciable quantities, according to the WPB.

Construction Materials Supply Situation

A summary of the supply situation for construction materials and components was issued August 6 by the WPB. Though forecasting improvement in the availability of supplies, WPB said that "several months may elapse before more materials actually appear on the shelves of suppliers or in the yards of distributors."

The effects of the end of the European war are not yet apparent in the general supply situation, WPB pointed out. Data on production and availability of several construction items follow:

STEEL:

Seamless pipe—Mills are booked through September, and will be booked through the fourth quarter as soon as allotments are issued.

Electric weld pipe—Mills are booked through September; heavy demand is expected to continue as long as seamless production is tied up with the bomb program.

CAST IRON PRESSURE PIPE—Improvement in production, but supply situation still tight. In May, as compared with April, production increased 14 per cent, shipments increased 2 per cent and unfilled orders increased 5 per cent. Mills produced at about 36 per cent of current capacity. Total backlog equals 3 months' production at the May rate.

CAST IRON SOIL PIPE—No betterment in supply situation. Orders are very heavy and increasing. Production in May was 11 per cent greater than that for April; however, shipments increased 11 per cent, and unfilled orders increased 5 per cent. Mills operated at about 45 per cent of current capacity.

INSULATION BOARD—Civilian requirements may be subject to at least a 60 day delay in delivery. Raw materials are in adequate supply, but manpower shortages are limiting production. Demand is increasing.

CEMENT ASBESTOS PRODUCTS:

Pipe—Relatively easy to obtain. Manufacturers still have inventories and reasonable requirements can be met in a short period of time.

HEATING EQUIPMENT—In general, stocks are in short supply but obtainable subject to varying delays in delivery; most difficult to obtain are cast iron radiators.

Coal Users Warned on Oil Conversion

Coal consumers who plan to convert space heating equipment to fuel oil because of a recent announcement by the Solid Fuels Administration that millions of Americans will have to keep warm next winter on 80 per cent of their normal coal supply are destined to disappointment, Deputy Petroleum Administrator Ralph K. Davies warned July 31. Military requirements are such that there will be no fuel oil available for those who attempt to convert, he said.

* * * * *

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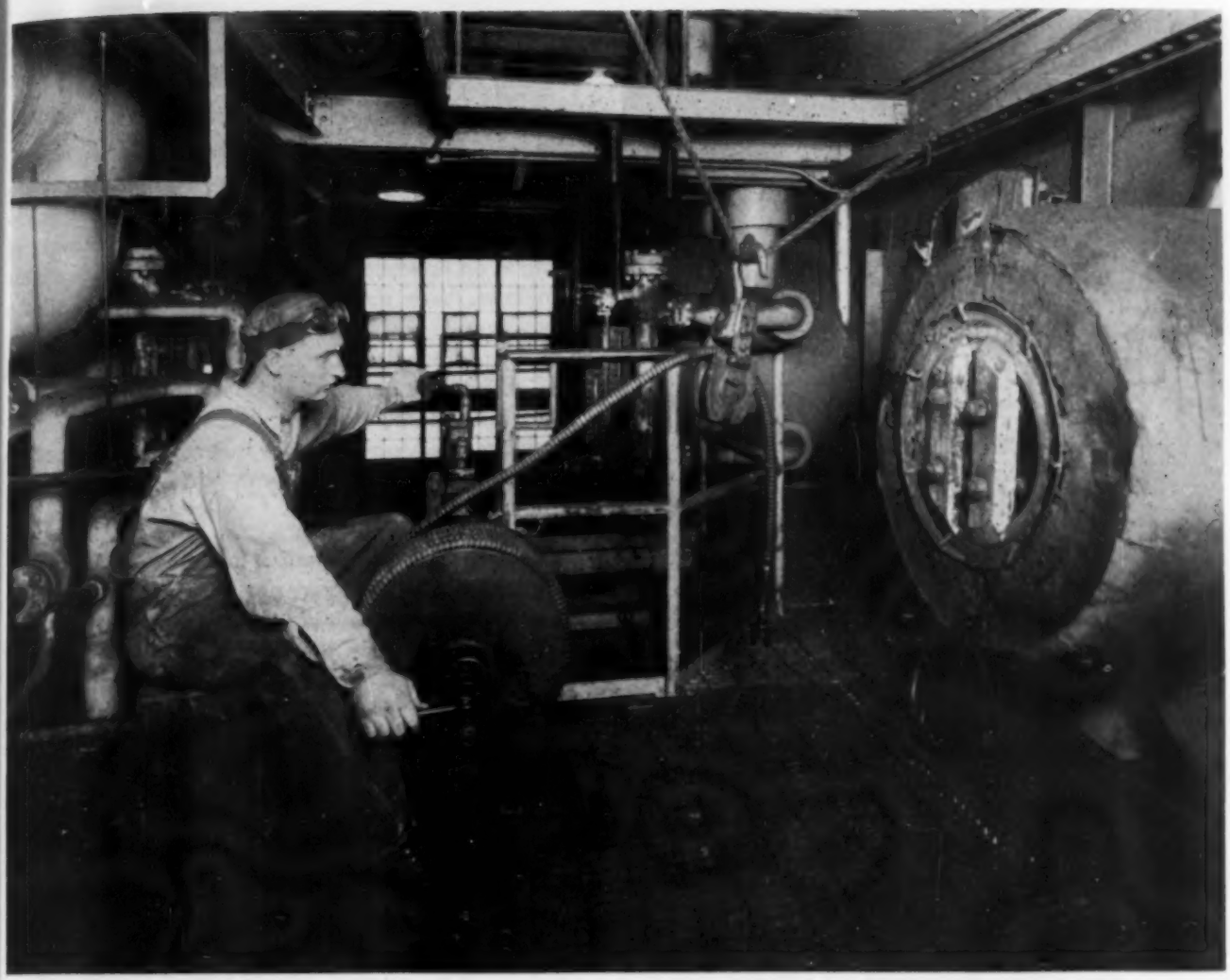
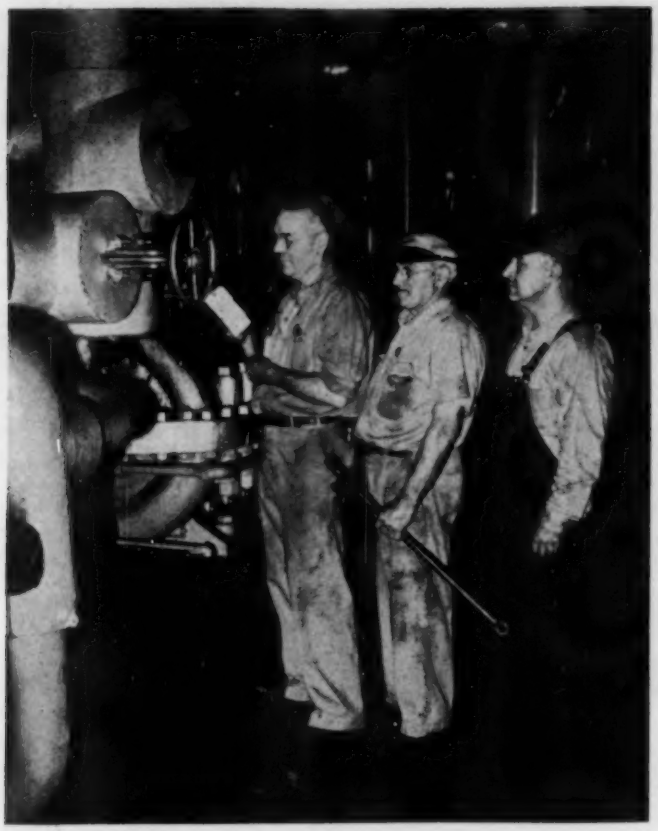


• Johnnie Grieve operating reel developed at Delray to rewind long turbining hose after cutting out boiler tube scale. Formerly pulled out by hand

SAFETY ON THE JOB

THE Delray plant of The Detroit Edison Co. gives careful attention to safety problems, and leaves no stone unturned in the effort to find safer ways of doing things on the job. Much of the success of the system is due to the wholeheartedness with which everyone pitches in to the never-ending effort of detecting possible sources of injury before they occur.

• Chain operation of gas valves as John Novak is doing here eliminates ladders and the necessity for climbing up several feet to the work area



• Before Pipefitter Joe Turbok can start work, line must be cut out properly by Gould Conner (fastening protective red tags) and Bill Manley, center

Suggestions from the men on the job are welcomed, and the plant has developed an informal procedure for handling them. When a workman thinks of something that might be done to improve the margin of safety in an operation, he usually talks it over with his associates, then mentions it to his foreman. If the idea is promising and seems basically sound, the foreman helps him develop the safety idea in practical form and gets it into writing. It is then passed on to others in authority and given thoughtful deliberation. When accepted, a work order is issued and the project is assigned to the man who can best effect the change in procedure or installation.

The men at Delray realize that this kind of safety engineering is neither easy nor hit-or-miss. They keep the goal constantly in mind, report all injuries, analyze their causes—yet try always to get in there with a remedy before the accident can occur. By their teamwork approach to this great problem, the plant has definitely improved the safety of operations and indicated the value of a long-term program in this direction.

• Boiler and stoker cleaning hazards are overcome with good protection equipment. G. Monge has safety goggles, respirator, 28-volt extension cord

• Harry Hoover checks weight of a fire extinguisher. Periodic checking of this sort assures preparedness of fire fighting equipment in an emergency

Heating, Piping & Air Conditioning

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Journal Section

The Use of Fuel Consumption and Equipment Data in the Abatement of Atmospheric Pollution†

Part II of Air Pollution Survey Report

By Arthur C. Stern*, New York, N. Y.

SUMMARY—To provide the basis for planning the abatement of atmospheric pollution in New York City, data were obtained on the quantity of each fuel type burned in the city in 1935, its geographic distribution within the city and the number, size and use of each unit of fuel burning equipment found by survey (1936-37) in New York City buildings. The use of this fuel consumption data to predict the intensity of atmospheric pollution has been demonstrated. This is the first presentation of the final data resulting from the survey.

Introduction

THE THREE objectives of the New York City Air Pollution Survey which was conducted by the New York City Department of Health in 1936 and 1937 were: (*a*) To study air-borne bacteria (1)[1]; (*b*) To locate the sources of solid particulate and gaseous pollution; and (*c*) To measure this solid particulate and gaseous pollution in the city's air (2).

Although some preliminary reports (3) of the survey have already been published, this series of four papers represents the first presentation of the Survey's final data.

Solid particulate pollution as discussed in this paper includes neither air-borne bacteria nor pollen; and gaseous pollution does not include odor nuisances. By virtue of these exclusions, solid particulate and gaseous air pollution consists essentially of smoke, cinders, fly ash and flue gases from the combustion of fuels. This study is therefore one of fuel utilization and fuel burning equipment distribution in New York City in 1935, 1936 and 1937 as a means for providing the Department of Health with the basic data on the type, location and intensity of air pollution sources so that their abatement might be intelligently planned.

Fuel Survey

All of the basic data on New York City's fuel consumption was obtained from each railroad and steamship line bringing fuel to the city by summarizing their statistics on the extent and destination by borough of each such shipment during the calendar year 1935. In most instances railroad and steamship shipments lose their identity at New Jersey tidewater, and therefore the only way they could be traced further was to determine the routing of each fuel barge from New Jersey to New York during the year in question. This difficult task was accomplished with the cooperation of the U. S. Army Corps of Engineers, the Port of New York Authority, the New York State Department of Waterways and Canals, and others. Since this was a survey of fuel actually burned in New York City, fuel shipments to the city were corrected by subtracting the quantity of fuel used for manufacturing gas. Neither gas making nor the burning of manufactured gas con-

†The second of a series of four abridged reports of the New York City Air Pollution Survey conducted by the New York City Department of Health, Ernest L. Stebbins, Commissioner, under the supervision of Sol Pincus, Deputy Commissioner and Sanitary Engineer.

*Chief Engineer, Division of Industrial Hygiene, New York State Department of Labor. Formerly (1936-37) Superintendent in charge of New York City Air Pollution Survey.

[1]Numerals in parentheses refer to Bibliography.

Table 1—Total Fuel Consumption of City—Annual Consumption in Thousand Tons and Thousand Gallons Per Year

(New York City Fuel Survey)

Type of Fuel Consumed	Borough					Total
	Manhattan	Brooklyn	Bronx	Queens	Richmond	
Anthracite coal	3,225	3,348	2,117	1,694	459	10,843
Bituminous coal	3,461	2,136	1,113	573	243	7,526
Coke	212	313	99	168	17	809
Total solid fuel	6,898	5,797	3,329	2,435	719	19,178
Fuel oil—industrial	224,541	146,644	48,654	26,651	29,671	476,161
Fuel oil—domestic	50,430	72,336	41,160	26,081	7,553	197,560
Fuel oil—total	274,971	218,980	89,814	52,732	37,224	673,721
Gasoline	134,590	150,870	75,190	132,970	6,380	500,000

Table 2—Industrial and Domestic Fuel Use—Annual Consumption in Thousand Tons and Thousand Gallons Per Year

(New York City Fuel Survey)

Type of Fuel Consumed	Borough					Total
	Manhattan	Brooklyn	Bronx	Queens	Richmond	
	A. Central Station, Railroad, Marine and Automotive Use					
Anthracite coal	475	49	4	6	18	552
Bituminous coal	2,778	1,746	986	336	147	5,993
Total solid fuel	3,253	1,795	990	342	165	6,545
Fuel oil—total (industrial)	117,639	80,939	3,093	5,910	26,567	234,148
	B. Industrial, Commercial and Residential Use					
Anthracite coal	2,750	3,299	2,113	1,688	441	10,291
Bituminous coal	683	390	127	237	96	1,533
Coke	212	313	99	168	17	809
Total solid fuel	3,645	4,002	2,339	2,093	554	12,633
Fuel oil—industrial	106,902	65,705	45,561	20,741	3,104	242,013
Fuel oil—domestic	50,430	72,336	41,160	26,081	7,553	197,560
Fuel oil—total	157,332	138,041	86,721	46,822	10,657	439,573

tributed adversely to the city's air pollution. The total obtained in this manner included fuel burned in central stations for the generation of electricity and district steam but did not include that burned in marine vessels, automotive vehicles and railroad locomotives for which separate surveys had to be conducted.

Marine Survey: The *Marine Survey* assembled data from all companies and agencies operating commercial vessels in the waters adjacent to New York City as to the type and quantity of fuel consumed by each vessel while in these waters. From these data marine fuel consumption was determined for the city as a whole. Information was also assembled as to the usual water areas in which each vessel operated so that the total fuel consumption could be allocated in proper proportions to each water area. For this purpose, water areas were so chosen that wherever possible, they were bounded by extensions of established Health District land boundaries. Therefore, it was possible, after the fuel consumption of each water area was determined, to assign it arbitrarily to the adjacent Health Districts in proportion to the length of their abutting shore line and the extent of their shore activity. The marine fuel consumption of each borough was obtained by adding the assigned marine fuel consumption of all Health Districts in a borough.

Automotive Survey: The *Automotive Survey* was based on a different approach to the problem of determining how much gasoline was consumed in the various districts and boroughs of the city. Advantage was taken of the fact that the New York City Police Department had made a traffic survey of the city in 1936 and had allowed the Department of Health to use the data obtained. Although the traffic survey was reported in terms of peak hour density, additional data available allowed the results to be interpreted in terms of the number of cars in motion per average hour in each area of the city. By assuming that, under city driving conditions, a car in motion for an hour would consume a gallon of gasoline, the city's annual gasoline consumption was estimated at 525,000,000 gal. However, data based on New York State gasoline tax records indicated a probable consumption of 475,000,000 gal. Therefore, the average of these estimates (500,000,000 gal) was used as the probable consumption. The percentage of this half billion gallons of gasoline consumed in each district and borough was assumed the same as the ratio of the total number of cars in motion per average hour in the district to the number for the city as a whole.

Railroad Survey: The *Railroad Survey* was based on data from the several railroads, operating within the city limits, on fuel utilization by locomotives operated therein. This was distributed among the districts and boroughs in proportion to locomotive use and trackage in each such area. The annual fuel consumption per coal burning and fuel oil burning locomotive, whether Diesel or steam, was considered uniform for the purpose of this distribution. After all data on marine, automotive and railroad fuel consumption had been carefully checked with that previously obtained on fuel movements into the

Table 3—Number of Buildings of Various Types in New York City From Real Property Inventory—1934

Borough	Industrial[a]	Commercial[a]	Other Non-residential	Multiple Dwellings	1- and 2-Family	Total
Manhattan	1,057	13,644	13,752	35,063	21,424	84,940
Brooklyn	3,877	13,663	8,764	51,888	193,493	271,685
Bronx	719	5,253	3,158	17,940	40,183	67,253
Queens	1,800	10,019	4,362	10,266	182,659	209,106
Richmond	1,600	2,272	1,647	542	34,224	40,285
New York City	9,053	44,851	31,683	115,699	471,983	673,269

[a]Loft buildings classified as commercial.

Table 4—Manhattan Fuel Burning Equipment Survey—Equipment Data

A. Number of Units—(Central Stations Excluded)			
Buildings—visited	72,773	Surveyed buildings without units	23,745
Buildings—no access	3,311	Surveyed buildings with units	45,717
Buildings—surveyed	69,462	Number of units	75,987

B. Use of Units	Buildings	Units	C. Type of Units	Buildings	Units
Heating boilers	32,958	36,910	Vertical firepot	32,900	36,972
Hot air heaters	3,006	3,159	Horizontal sectional	23,842	25,781
Hot water heaters	31,829	32,325	Integral furnace	5,363	7,465
Power boilers	369	854	Fire tube—brick set	2,189	3,422
Process equipment	675	1,166	Water tube—single drum	272	631
Unused	1,381	1,583	Water tube—multi-drum	89	207

city, to avoid inclusion of the same fuel in both estimates, addition of the two yielded the total consumption of each fuel type. (Table 1)

Industrial, Commercial and Residential Fuel Usage

Air pollution abatement as it affects central stations and marine, automotive, railroad and other mobile sources, while of utmost importance in achieving a purer atmosphere, is beyond the normal field of activity of the heating and ventilating engineer. His principal concern is with the vast multitude of stationary sources in industrial, commercial and residential buildings. The fuel consumption of the latter group (Table 2, part B) was determined by subtracting from the total fuel consumption of the city (Table 1) that portion, determined by the special studies already discussed, consumed in Central Stations and mobile equipment (Table 2, part A). Because of the methods used in the *Fuel Survey*, it was not possible to break down Table 2, part B, further into its component parts without the aid of additional data. Fortunately, these additional data were available from the results of the *Fuel Burning Equipment Survey*.

Fuel Burning Equipment Survey

The purpose of the *Fuel Burning Equipment Survey* was to determine the type of fuel burning equipment installed in the industrial, commercial and residential structures of the city. The value of this information besides its already indicated use of further analysis of Table 2, part B, is that it allows a prediction of future trends in atmospheric pollution which may be caused by changes in fuel consumption under the influence of adverse supply or price. For the use of the Health Department in its immediate job of planning and prosecuting its air pollution abatement work, this survey also provided information on fuel consumption and type of fuel burning equipment in each individual building surveyed as well as on the borough wide and city wide basis reported here. Other data, difficult to summarize, and therefore not included in this paper such as the make and model number of boilers, the setting height of grates, and the storage capacity for fuel, were obtained and made available to the Health Department for use in its smoke abatement activities.

In 1934, the New York City Department of Housing and Buildings completed a survey of all structures in the city. This, as summarized in Table 3, shows that there were 673,269 potential fuel consuming buildings in the city. Surveys of these buildings were made as follows:

a Each building in Manhattan was surveyed by a field investigator.

b Each industrial‡ building in the other four boroughs was surveyed by a field investigator. (Only those in Brooklyn are included in this Report).

c Each of 5000 non-industrial‡ buildings in a representative district in Brooklyn were surveyed by a field investigator. (Similar sampling surveys were to have been conducted in the other three boroughs if the survey had continued for a longer period of time).

‡Loft buildings were classified as Commercial, not as Industrial or Factory buildings.

It is, therefore, evident that the data herein reported were based upon surveys of building groups, which according to the Real Property Inventory should total approximately 100,000 structures and represent about 15 per cent of all structures in the city. The actual number of buildings surveyed was smaller than this total by 18,000, the difference being due to the fact that the Real Property Inventory included as structures, warehouses, sheds, shacks, barns, garage colonies and an array of similar small unheated structures which were not included in the *Fuel Burning Equipment Survey*.

Field investigators of the Survey were instructed to exclude all equipment originally manufactured to burn gas, but to include all standard type boilers and furnaces built for solid or liquid fuel but which were currently burning gas. They were further instructed to limit their field investigation to fuel burning equipment installed at the basement or first floor level and not to survey each apartment in the *cold water* tenements without central heating or hot water, or the upper floors of loft or factory buildings. All information on upper floor process equipment and its fuel usage was obtained by questioning the building superintendent, factory manager or operating engineer.

As would be anticipated, those

Table 5—Brooklyn Fuel Burning Equipment Survey—Equipment Data

	All Industrial[a] Buildings in Brooklyn		1- and 2-Family Residences in Bedford District		Multiple Dwellings in Bedford District		Commercial[a] Buildings in Bedford District	
A—Number of Units	Buildings	Units	Buildings	Units	Buildings	Units	Buildings	Units
Buildings—Visited	2,083	....	2,826	....	2,046	....	128	....
Buildings—No access	108	....	204	....	63	....	1	....
Buildings—Surveyed	1,975	....	2,622	....	1,983	....	127	....
Surveyed buildings without units	710[b]	0	643	0	420	0	89	0
Surveyed buildings with units[c]	1,265	3,586[d]	1,979	2,917	1,563	2,720	38	89
B—Use of Units								
Building heating	792[e]	1,002[e]	1,964	1,993	1,531	1,549	33	39
Hot water	....	....	888	889	1,104	1,108	24	24
Power	355	712	3	3	14	20	8	17
Process	414	1,723	11	13	1	2	3	3
C—Type of Units								
Water tube boilers	114	376	0	0	1	2	5	19
Fire tube boilers	645	989	127	134	110	118	5	12
Cast iron boilers	514	595	2,211	2,755	2,032	2,577	49	55
Process equipment	414	1,626	11	13	1	2	3	3

[a]Loft buildings classified as commercial, not as industrial.
[b]Includes 380 buildings receiving heat or power from other buildings.
[c]Includes units burning waste fuels and some whose use and type were not ascertained.
[d]2800 of these units burn solid or liquid fuel.
[e]Includes hot water.

Table 6—Manhattan Fuel Burning Equipment Survey—Fuel Data—Annual Fuel Consumption in Thousand Tons and Thousand Gallons Per Year

Type of Fuel Burned	Buildings	Units	Annual Fuel Consumption
Anthracite—Steam sizes	11,820	19,224	2,647
Domestic sizes	28,493	42,141	1,331
Total	38,479	61,365	3,978
Bituminous—Run of mine	245	392	81
Sized	154	237	28
Slack	1,618	2,533	408
Total	2,016	3,162	517
Coke	4,284	5,139	154
Miscellaneous solid fuels	83	128	20
Total solid fuels	....	69,794	4,669
Fuel oil—Industrial	968	1,816	116,000
Domestic	2,280	2,664	25,100
Total	3,238	4,480	141,100

buildings, which did have units of fuel burning equipment installed, had in many instances more than one unit, as for example, two boilers, one for heating and one for hot water. The Survey therefore shows more units than buildings, both in total and in each category (Tables 4 and 5). These tables indicate the large number of buildings without central heating or hot water; the small number of hot air heaters; and the large number of cast iron boilers of the vertical firepot and horizontal sectional types.

The summarized data of the field investigators regarding *type* of fuel burned in each building unit, as shown in Tables 6 and 7, may be considered much more accurate than the summary of their reports of the *quantity* of fuel consumed therein. Comparing the total industrial, commercial and residential consumption of each type of fuel in the borough of Manhattan as reported by the *Fuel Survey* (Table 2, part B) with that of the house-to-house survey (Table 6), reveals a reasonably good agreement in the case of bituminous coal and industrial fuel oil but a noteworthy discrepancy in the cases of anthracite coal and domestic fuel oil. The most reasonable explanation for the 1.2 million ton excess of anthracite indicated by the house-to-house survey over the *Fuel Survey* is a cumulative overstatement of annual consumption on the part of tens of thousands of householders, janitors, and building superintendents. Just why the reverse situation should occur in the case of domestic fuel oil is obscure. The most likely explanations are either faulty borough distribution data on this fuel, or an accumulation of errors in classifying No. 3 fuel oil as *industrial* by block surveyors, whereas it was classified as *domestic* in the *Fuel Survey*.

Estimation of Area Consumption from Smaller Sample

Since the house-to-house survey data for Brooklyn (Tables 5 and 7) covered commercial and residential buildings in the Bedford Health District only, they did not yield totals which could be compared directly with the *Fuel Survey* data. However, the Bedford data allow a check estimate to be made of the borough's industrial, commercial and residential fuel consumption. Borough industrial consumption was surveyed directly. Commercial consumption was estimated. For residential consumption, the sample in the Bedford district was accepted as representative of the borough as a whole and used in the following manner: The number of fuel consuming residential buildings in Brooklyn was assumed to be 15 per cent lower than the total number of such buildings in Table 3. This reduction is based upon survey experience already discussed. The number of fuel burning units per fuel consuming building calculated from Table 5 are: 1.09 in one- and two-family houses and 1.31 in multiple dwellings. These ratios are low because of the exclusion of stoves, space heaters and gas appliances as fuel burning units. The product for a specific type of building of (a) the number of fuel consuming buildings and (b) the number of fuel burning units per fuel consuming building yields the number of fuel burning units in all the buildings of that type in the borough, i. e., 180,000 in one- and two-family houses and 58,000 in multiple dwellings. It was estimated that there were 12,000 fuel burning units in commercial buildings in the borough. In making this estimate cognizance was taken of the fact that a very large percentage of Brooklyn retail stores occupy the street floor of multiple dwellings and are classed as such rather than as commercial buildings. The number of solid or liquid fuel fired units in factories (2800) did not require computation because it was determined directly in original Survey (Table 7).

To estimate how many of these residential units burned each type of fuel, use was made of the *per cent units* column of Table 7. Thus, if the Bedford District is truly representative of the borough, 5.1 per cent of the 180,000 fuel burning units in one- and two-family houses

Table 7—Brooklyn Fuel Burning Equipment Survey—Fuel Data Annual Fuel Consumption in Tons and Thousands of Gallons Per Year

Type of Fuel Burned	Buildings	Units	Per Cent Units	Annual Fuel Consumption	Annual Fuel Consumption/ Unit
A. All Industrial[a] Buildings in Brooklyn					
Anthracite—Steam sizes	168	353	12.7	127,000	360
Domestic sizes	279	426	15.2	13,000	30
Bituminous coal	344	723	25.8	696,000	840
Coke	90	258	9.2	11,000	43
Fuel oil—Industrial	292	798	28.5	84,000	105.0
Domestic	139	242	8.6	2,000	8.0
B. 1- and 2-Family Residences in Bedford District					
Anthracite—Steam sizes	98	147	5.1	8,200	55.8
Domestic sizes	1,378	2,102	73.1	25,800	12
Bituminous coal	8	11	0.4	600	50
Coke	115	166	5.8	1,800	11
Fuel oil—Industrial	28	21	0.7	393	18.7
Domestic	419	429	14.9	1,214	2.8
C. Multiple Dwellings in Bedford District					
Anthracite—Steam sizes	253	418	15.4	26,200	63
Domestic sizes	1,117	1,923	71.4	25,500	13
Bituminous coal	8	14	0.5	700	49
Coke	64	86	3.2	1,100	13
Fuel oil—Industrial	28	32	1.2	2,087	65.0
Domestic	205	224	8.3	659	2.9

[a]Loft buildings classified as Commercial, not as Industrial.

in the borough burn steam sizes of anthracite. Furthermore, if each of these 9180 units had an *annual fuel consumption per unit* equal to that so listed in Table 7, each would burn 55.8 tons of the steam sizes of anthracite per year. A similar computation for each fuel type was made for both one- and two-family houses and multiple dwellings. Consumption of each type fuel in Brooklyn factories was known from the field survey data already discussed. The commercial consumption of each fuel type in the borough was estimated as 5 per cent of the residential and industrial consumption data previously mentioned. Total industrial, commercial and residential fuel usage in Brooklyn (Table 8) could, therefore, be compiled by tabulating these individual estimates. Since the total consumption of each fuel indicated by this table agrees as closely as it does with the borough's industrial, commercial and residential consumption as estimated in Table 2, part B, the method of analysis employed seems to be justified. It indicates that with a larger sample of residential and commercial buildings, even closer agreement might have been achieved.

A breakdown of the city-wide industrial, commercial and residential fuel consumption of Table 2, part B, into its components was made by the use of methods analogous to those just discussed (Table 9). In charting the data of this table (Fig. 1), use was made of the artifice of substituting for fuel oil consumption in gallons, its Btu equivalent in tons of coal. Therefore, in this figure solid fuel is plotted directly in thousands of tons, while fuel oil is shown in thousands of equivalent tons. Even though it is realized that this distribution represents no more than an *intelligent guess* (to the extent that it includes fuel use in buildings not actually visited in the Survey) it serves a useful purpose in highlighting the problems facing any air pollution abatement effort in New York City.

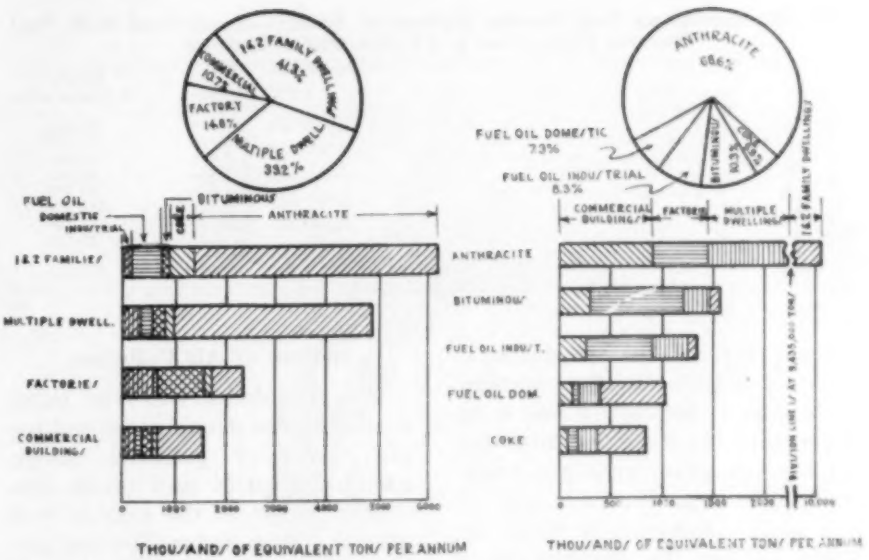

Fig. 1—Industrial, commercial and residential fuel consumption in New York City—1936

Grate Area Studies

Of the 75,997 units of fuel burning equipment in Manhattan, 69,425 were hand-fired with solid fuel. The size characteristics of this latter group of units were analyzed. Square feet of grate area per unit was chosen as the basis of this analysis because it was felt to be a more accurate index of unit size than either annual fuel consumption per unit (based on statements made by each householder or building superintendent) or boiler heating surface (on which data were not always available). This study (Table 10) indicates that most grate area (and consequently most fuel consumption) occurs in the 17,426 units having over 10 sq ft of grate area per unit. In two of the seven Manhattan health districts, grate area analysis was extended to include hand-fired grate area distributed according to type of fuel burned (Table 11). It will be noted from this table that the average grate area of a unit burning bituminous coal or the steam sizes of anthracite is between 21 and 23 sq ft,

Table 8—Annual Industrial and Domestic Fuel Consumption in Brooklyn—Estimated from Fuel Burning Equipment Survey Data

		Annual Fuel Consumption[a] in Thousands of Tons and Thousands of Gallons in—			
	Units[a]	Industrial[b] Buildings	Commercial[b] Buildings	Multiple Dwellings	1- and 2-Family Residences
Anthracite—Steam sizes	18,200	127	60	560	512
Domestic sizes	182,300	13	106	535	1,570
Total	201,500	140	166	1,095	2,082
Bituminous coal	1,800	606	32	14	36
Coke	13,100	11	7	24	114
Total solid fuel	216,400	757	205	1,133	2,232
Fuel oil—Industrial	2,900	84,000	7,600	45,000	23,400
Domestic	33,500	2,000	4,500	13,900	75,000
Total	36,400	86,000	12,100	58,900	98,400

[a]Exclusive of non-residential buildings not classified as industrial or commercial, for which no estimate is available.
[b]Loft buildings classified as Commercial.

Table 9—Breakdown of New York City Annual Industrial and Domestic Fuel Consumption—in Thousand Tons and Thousand Gallons Per Year
(Excluding Gasoline, Gas, and Coal or Oil used to make Gas)

Type of Fuel Consumed	Industrial[a]	Commercial[a]	Multiple Dwellings	1- and 2-Family	Total Industrial, Commercial and Residential
Anthracite coal	549	919	3,967	4,856	10,291
Bituminous coal	911	278	267	77	1,533
Coke	98	74	159	478	809
Total solid fuel	1,558	1,271	4,393	5,411	12,633
Fuel oil—Industrial	112,543	46,731	62,253	20,486	242,013
Domestic	9,525	17,632	43,346	127,057	197,560
Total	122,068	64,363	105,599	147,543	439,573

[a]Loft buildings classified as commercial.

Table 10—Manhattan Fuel Burning Equipment Survey—Hand-Fired Solid Fuel Burning Grate Area in All Districts of Borough

Sq Ft of Grate Area Per Unit	Units	Sq Ft of Grate Area
0- 2.4	29,303	36,629
2.5- 4.9	10,106	37,897
5- 7.4	6,986	43,663
7.5- 9.9	5,604	49,035
10-19.9	8,745	131,175
20-29.9	4,661	116,525
30-59.9	3,740	168,300
Over 60	280	20,686
Total	69,425	603,910

whereas for coke or the domestic sizes of anthracite the average grate area is between 4 and 6 sq ft per unit. In these two districts, the average grate area per hand-fired unit, regardless of fuel, is 11.7 sq ft. However, as shown in Table 10 for the borough as a whole the average grate area per unit is lower (8.7 sq ft), indicating that the two districts analyzed in Table 11 have larger sized units than the borough as a whole. It should further be noted that, because buildings in Manhattan are larger on the average than in the other four boroughs, the average sized unit in the city as a whole is most likely of considerably smaller grate area than 8.7 sq ft. A similar study of the 15,218 sq ft of stoker-fired grate area in Manhattan (exclusive of stokers in central stations) showed an average size of 21 sq ft of grate area per unit, which is in the same range as the units hand-fired with bituminous coal or with the steam sizes of anthracite.

Further use was made of the previously mentioned grate area data to check the *Fuel Survey*. Coal consumption per degree-day was taken as 22 tons per billion Btu per hour heat requirement and it was further assumed that 13,000 Btu coal is burned in hand-fired units at the rate of 6 lb per sq ft of grate area per hour at 60 per cent efficiency, and in stoker-fired units at 12 lb per sq ft of grate area per hour at 70 per cent efficiency. Since there were 5437 degree-days in New York in 1935-36, a computation based upon the aforementioned data indicates an annual solid fuel consumption of 3,326,000 tons in hand-fired units; 200,000 in stoker; making a total consumption of 3,526,000 tons. This total shows excellent agreement with the 3,645,000-ton estimate of the *Fuel Survey* for the same usage.

Indices of Air Pollution

The remainder of this paper deals with the development and use of indices of potential cinder, gaseous pollution and smoke production based on the sum of both central station and mobile fuel consumption and the industrial, commercial and residential fuel consumption previously discussed.

Because fuel oil has no appreciable ash content, an area's consumption of solid fuel (*i. e.*, coal and coke) should be its index of potential cinder production.

Because both liquid and solid fuels produce flue gases containing quite similar percentages of CO, CO_2 and SO_2 an area's total fuel consumption should be its index of potential atmospheric contamination by these gases.

Because anthracite and coke are usually burned smokelessly, an area's consumption of bituminous coal and fuel oil should be its index of potential smoke production.

These three indices will be useful to the extent that they offer guidance as to where and how to concentrate abatement efforts; and to the extent that they check the accuracy of other survey results by correlation with pollution actually measured. The cinder production index should correspond most closely with soot fall, since soot fall is measured by weighing settled matter. The smoke index should correspond to field measurements of smoke density and the gaseous pollution index with the results of chemical analyses of air samples for gaseous contamination.

The preparation of these indices require that data on solid and liquid fuel consumption be added so that a single number representing total fuel consumption can be obtained as the index. To accomplish this, fuel oil and gasoline were converted to the equivalent number of tons of coal which would have the same Btu. The indices thus obtained (Table 12) are tabulated only on borough wide and city wide bases. They have been, however, plotted (Figs. 2, 3 and 4) on a health district basis (using a detailed breakdown of data not included in this paper) in order that their correlation with field measurements of atmospheric pollution may be more dramatically demonstrated.

Indices of the type discussed do not differentiate between the consumption within an area of a million tons of coal in one large central station power plant and the same quantity distributed over many thousands of smaller users.

Table 11—Manhattan Fuel Burning Equipment Survey—Hand-Fired Solid Fuel Burning Grate Area in Two Districts of Borough Distributed According to Type of Fuel Burned

Type of Fuel Consumed	Units	Sq Ft of Grate Area
Anthracite—Steam sizes	7,462	154,712
Domestic sizes	12,070	73,162
Total	19,532	227,874
Bituminous—Total	892	20,052
Coke	1,237	5,405
All solid fuels	21,661	253,331

Table 12—Indices of Potential Air Pollution[a]—Thousands of Equivalent Tons

Borough	Area in Acres	Cinder Production Index	Smoke Production Index	Gaseous Pollution Production Index
Manhattan	12,361	6,898	4,940	9,111
Brooklyn	44,374	5,797	3,310	7,802
Bronx	25,887	3,329	1,592	4,222
Queens	64,894	2,435	865	3,429
Richmond	38,400	719	444	955
New York City total	185,916	19,178	11,151	25,529

[a]Indices may be converted to a *per acre* basis by dividing each by the acreage of the area in question.

Fig. 2—Total solid fuel consumption in New York City—1935; Index of potential cinder production

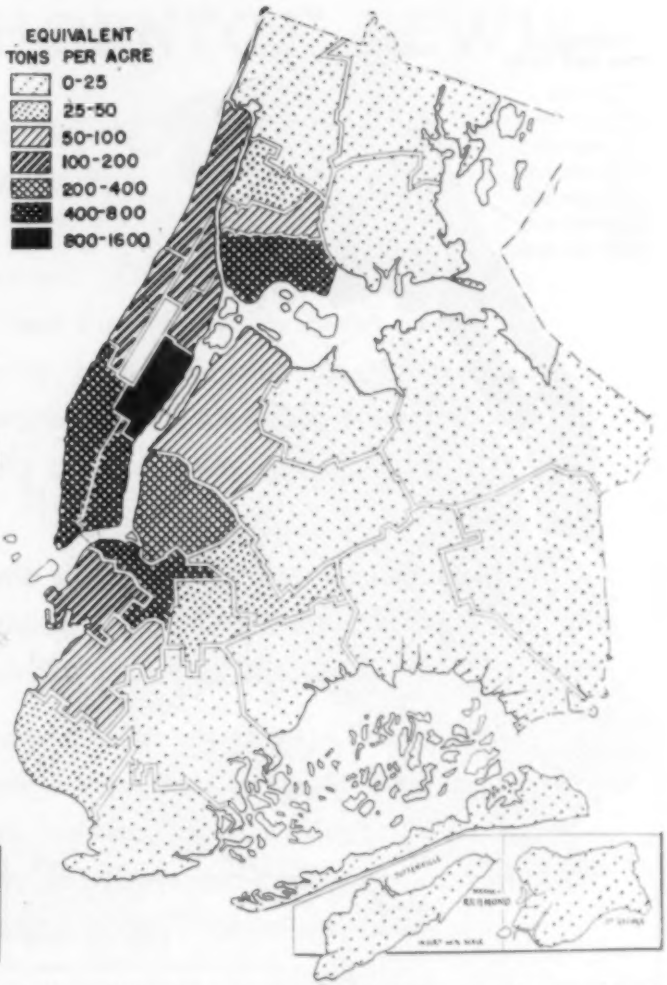

Fig. 3—Bituminous coal and fuel oil consumption combined in New York City—1935; Index of potential smoke production

This lack of differentiation is important to the extent that the prevention of central station stack emission through the use of cinder catchers, fly-ash precipitators and automatic combustion control makes fuel consumption a false index of pollution therefrom. However, a study of the means of preventing stack emission from New York City central stations installed at the time of this survey indicated that, with but few exceptions, the means provided did not, in fact, decrease stack emission to less than that which would have been caused by the combustion of an equivalent quantity of fuel by many smaller users. In fact, in most instances, the contrary was true. It should be noted that indices could also have been prepared in which the central station fuel usage of each area and borough was weighted by the degree that preventive means had made stack emission from these plants greater or less than the norm of non-central usage.

It should be further obvious that indices can also be prepared using only industrial, commercial and residential fuel consumption, or any component thereof and that the indices so prepared may be mapped to show separately the effect on the city's air pollution of the broad base of fuel consumption in industrial, commercial and residential establishments as contrasted with the superimposed load caused by public utilities and mobile equipment.

Even though more refined indices might have been used, those actually employed, *i. e.*, Figs. 2, 3 and 4, are, in the author's opinion, as precise as the accuracy of the basic data will allow and do, in fact, still in 1945, truly represent the sources of New York City's air pollution. As such, these maps are invaluable in showing where air pollution abatement activity is most needed.

Correlation of Indices with Field Measurements of Pollution

No satisfactory correlation of the smoke and gaseous pollution indices with field measurements was obtained by the survey because of an insufficient mass of usable field measurements. Satisfactory field measurements of smoke pollution are lacking because despite repeated efforts using large numbers of observers following accepted standard smoke measurement techniques, no trustworthy data could be obtained. Satisfactory field measurements of gaseous pollution, *i. e.*, SO_2, are lacking because, after abandoning as unreliable the lead peroxide cylinder (one month exposure) method of measuring atmospheric sulphur, following a year's trial of the method, it was considered too late to institute the intensive spot sampling procedure

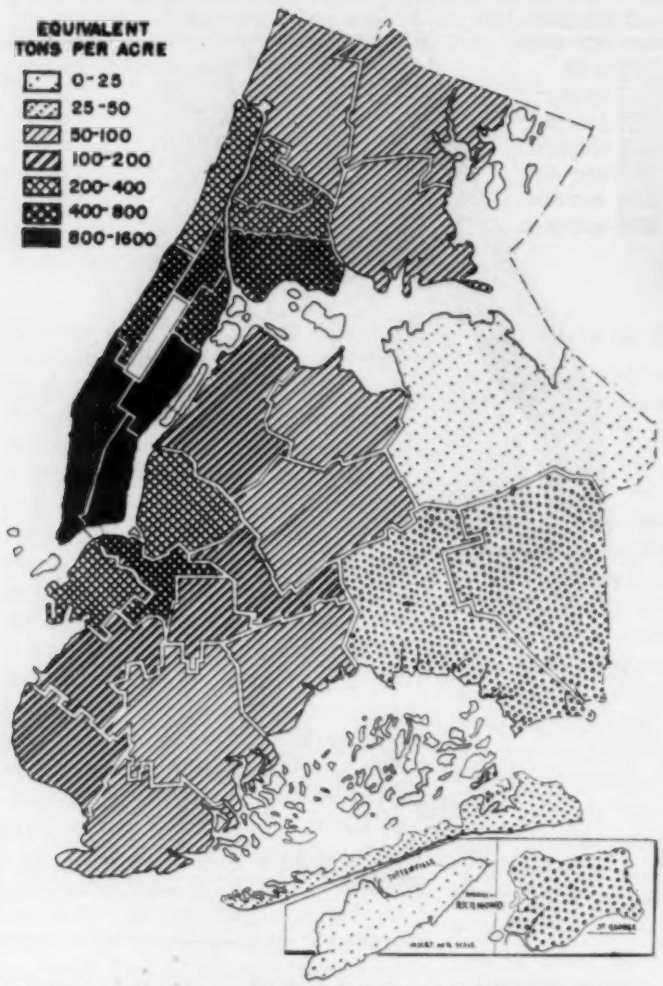

Fig. 4—Total fuel consumption in New York City—1935; Index of potential gaseous pollution production

Fig. 5—Sootfall in New York City—average total solids per square mile per month—1936

that would have been required to supply the necessary data.

It was gratifying, therefore, that the remaining index of cinder production (Fig. 2) corresponded so well with the field measurements of soot fall (Fig. 5) which will be reported in Part III of this report covering the results of the survey on measuring solid particulate pollution in New York City air. This correlation is noteworthy not only to the extent that soot fall results could have been predicted from the cinder index but also to the extent that these latter results reflect the known influence of topography and prevailing winds.

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MITTENDORFF LEAVES SARCO

Ed. M. Mittendorff, Chicago, Ill., has resigned as Vice President and General Manager of Sarcotherm Controls, Inc. and as engineer of Sarco Co., Inc., New York, N. Y.

Ed. M. Mittendorff

Mr. Mittendorff has been associated with the Mid-Western District Office of Sarco Co. since his graduation from Lehigh University in 1929 and in 1942 was appointed General Manager of the newly formed Sarcotherm Controls Co., an associate company of the Sarco Co.

Mr. Mittendorff has been a member of ASHVE for over 13 years and is active in other engineering societies. In 1941 he was president of the Illinois Chapter of ASHVE and for the last two years has been serving on the Society's Technical Advisory Committee on Radiation and Comfort.

A TRIBUTE TO THORNTON LEWIS

By H. P. Gant
Philadelphia, Pa.

THORNTON LEWIS has departed. On the morning of July fourth, Nineteen Hundred and Forty-Five, his great heart had reached the end of its journey, and his spirit soared to the beyond. He did not endure ill health nor was his going preceded by suffering or dread; he merely passed away quietly during the early hours of the morning.

An intensely patriotic man with great love for his country, he could not have chosen a more fitting time to leave this life than Independence Day. On that day, his soul was liberated.

Few of his friends and associates had the privilege of knowing him and his true worth as I have known him for more than 35 years. During that span of years, we were closely associated in times of depression and prosperity, in sorrow and happiness, and he was ever a true friend possessed of the highest attributes of American manhood.

In his soul there was a spirit of deep and abiding charity toward all of his fellow men and constantly he extended a helping hand to all with whom he came in contact.

As President of the American Society of Heating and Ventilating Engineers in 1929, he left the imprint of his ability by placing the Society on a firm financial basis and for nearly 20 years thereafter he retained his keen interest in the activities of the Society.

At the call of his Country in 1941, he joined the staff of the Ordnance Department, U. S. Army, and served with distinction until September, 1944. Perhaps he was one of the many war casualties but he could not have been happy unless he was giving to the utmost of himself, therefore, he was prepared to give all, even though it meant his life.

Loyal friend, militantly honest, a patriot possessed of the highest ethical standards: that was Thornton Lewis.

L. E. Seeley

Fred W. Powers

H. C. Mueller

Donald J. Powers

SEELEY NEW DEAN OF ENGINEERING

Appointment of Lauren Earl Seeley as Dean of the College of Technology at the University of New Hampshire, Durham, N. H., has been announced by President Harold W. Stoke.

Since 1923, Professor Seeley has been associate professor of mechanical engineering at Yale University, New Haven, Conn. In addition to his teaching, Professor Seeley serves as consultant on engineering and manpower problems for a number of government agencies, trade associations and private firms.

He was graduated magna cum laude from Yale in 1921 with the degree of Ph.B., and also holds M.E. and LL.B. degrees from that institution. His research has been concerned chiefly with heating and ventilation, including studies of wood burning devices and the effect of relative humidity on the respiratory system.

Until recently Professor Seeley has been regional advisor in Connecticut and Rhode Island for the Engineering, Science, and Management War Training program of the U. S. Office of Education. He is a special consultant to OPA on fuel oil and coal rationing problems and was a member of the committee which prepared the basic program for fuel oil rationing. He is a member of manpower committees for the *Manufacturers' Association of Connecticut*, the War Manpower Commission, and the U. S. Department of Labor.

He is a member of Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and is also chairman of the Publication Committee, a member of the Executive Committee and the Committee on Research.

In his new position, Professor Seeley will succeed George W. Case, whose retirement was announced recently.

In his announcement President Stoke said, "we consider ourselves fortunate to have found, in Professor Seeley, a man whose record shows sound scholarship supplemented by experience in teaching, research, administration and the practical application of engineering knowledge to business."

GIANNINI EVENING ENGINEERING DIRECTOR AT NYU

Prof. Mario C. Giannini, associate professor of mechanical engineering in the College of Engineering of New York University, has been appointed director of the Evening Division of the College of Engineering, it has been announced by Chancellor H. W. Chase.

Professor Giannini will continue as a member of the engineering faculty at University Heights and also will serve as director of war training and veteran coordinator in the College of Engineering. He became a member of the University faculty in 1926.

In taking over his new assignment he succeeds Assistant Dean Henry J. Masson, as director of the Evening Division. Professor Masson will continue to be in charge of the graduate division of the College of Engineering and chairman of the chemical engineering department.

Director Giannini is a member of the ASHVE, and is a member of the Board of Governors of its New York Chapter; a member of the Metropolitan Committee, National Fuel Efficiency Program, U. S. Department of Interior; Board of Engineers, Manpower Utilization Committee of the War Manpower Commission; and a member of the Society for the Promotion of Engineering Education.

He has served as a consulting engineer in heating, air conditioning and mechanical equipment of buildings, and as a consultant to publishers on engineering and technical textbooks. He is an advisor to the Division of General Education of New York University on vocational-technological training.

POWERS BROTHERS RETIRE AFTER 53 YEARS' SERVICE

After 53 years of active service with the Powers Regulator Co., Chicago, Ill., manufacturers of automatic temperature and humidity controllers and recorders, both Fred W. Powers and his brother Donald J. Powers of New York City, have retired from active duty.

Fred W. Powers, formerly president, is now chairman of the board of directors. He is a life member of the ASHVE, having joined in 1911 and served as a member of council in 1918-19. Donald J. Powers, formerly vice-president, remains as a director of the company and has been a Society member since 1930.

H. C. Mueller of Chicago, associated with the company since 1926 and formerly general manager, has been elected president and general manager.

F. A. Murray of New York City was elected vice-president in charge of the eastern division, and J. W. Powers of Chicago was re-elected vice president and is in charge of the western division.

Charles T. Blackmore of Chicago, former secretary, was elected secretary and treasurer, and Henry Halterman of New York City, assistant secretary.

LIBRARY BOOKS ACKNOWLEDGED

Since the announcement of the establishment of the John R. Allen Memorial Library at the ASHVE Research Laboratory in Cleveland, Ohio, the Director of Research, Cyril Tasker, reports a growing list of contributions from members and friends.

It is the desire of the Committee on Research to acknowledge with thanks the accompanying list of books which have been received recently for the Library.

The establishment of the John R. Allen Memorial Library is to honor the pioneer work of one of the Society's past presidents and the first director of its Research Laboratory.

Members of the Society who have books, pamphlets and other printed material dealing with the arts and sciences of heating, ventilating, air conditioning are invited to contribute such matter. A special bookplate will be placed in each volume and all contributed volumes will bear the name of the donor. Contributions should be sent by parcel post or express collect to the Director, ASHVE Research Laboratory, 10700 Euclid Ave., Cleveland 6, Ohio.

Title	Author	Donor
Refrigeration and Air Conditioning Engineering	B. F. Raber F. W. Hutchinson	Authors
Mechanical Engineering Practice	C. F. Shoop G. L. Tuve	G. L. Tuve
Heating and Air Conditioning	John R. Allen J. H. Walker	J. H. Walker
Engineering Thermodynamics	C. E. Lucke	Author
Climate and the Energy of Nations	S. F. Markham	Author
Building Insulation	P. D. Close	Author
Air Conditioning and Refrigeration	B. H. Jennings S. R. Lewis	S. R. Lewis
Air Conditioning Analysis with Psychrometric Charts and Tables	William Goodman	J. W. O'Neill (Trane Co. of Canada Ltd.)
John B. Pierce Laboratory of Hygiene Collected Papers, Vol. 1, 1934-1939		C.-E. A. Winslow L. P. Herrington A. P. Gagge E. J. Rodee
Gravity Warm-Air Heating	J. D. Hoffman	National Warm Air Heating and Air Conditioning Association
An Introduction to Modern Thermodynamical Principles	A. R. Ubbelohde	Oxford University Press
The Heating, Ventilating and Lighting of School Buildings	W. D. Seymour	Oxford University Press
Winter Air Conditioning Forced Warm-Air Heating	S. Konzo	National Warm Air Heating and Air Conditioning Association
Modern Combustion Coal Economics and Fuel Fallacies	C. V. Beck	Coal-Heat

SUMMARY OF LOCAL CHAPTER MEETINGS*

IOWA—May 15. Election of officers as follows: *President*, B. E. Landes; *Vice-President*, E. O. Olson; *Secretary-Treasurer*, C. A. Wheeler; *Board of Governors*, D. C. Murphy and R. K. Smith. M. L. Todd reported on work of building code committee, and urged members to submit technical papers for presentation at chapter meetings. Attendance, 17.

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KANSAS CITY—June 4. Subject: The U in Business. Speaker: Dr. Kenneth McFarland, Supt. of Schools, Topeka, Kans. New officers installed: *President*, R. B. Mason; *Vice-President*, S. L. Furber; *Treasurer*, R. L. Thomas; *Secretary*, P. C. Leffel; *Board of Governors*, D. M. Allen, M. M. Rivard and L. A. Stephenson. Attendance, 71.

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NORTH TEXAS—June 18. Subject: Engineered Air Distribution. Speaker: Vic Lathers, Repr., Barber-Colman. Mr. Lathers accompanied his talk with slides showing various installations of air outlets, laboratory tests, etc. Attendance, 49. Attendance ratio, 0.98.

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OREGON—April 5. Subject: Methods Used in Chemical Warfare, Including Gas Masks, Smoke Screens, Incendiaries of Different Types. Speaker: Mr. Caldwell, Lieut. Colonel in Chemical Warfare in World War I. Attendance, 19.

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PHILADELPHIA—May 10. Annual outing at Llanerch Country Club, Llanerch, Pa.

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WISCONSIN—May 15. National President's Night. Subject: The Air Cooled Human Body. Speaker: Dr. C.-E. A. Winslow, Pres. of ASHVE, New Haven, Conn. He described recent work having to do with the quantitative effects of air temperature, air movement, atmospheric humidity and the radiant temperature of surrounding surfaces upon heat loss and gain. Dr. Winslow emphasized that the factor of variation in individual response is one which makes the task of the heating, ventilating and air conditioning engineers so difficult. He concluded his talk with a brief discussion of some of his ideas as to the future of air conditioning and its application in the postwar world. Installation of officers: *President*, O. A. Trostel; *Vice-President*, E. W. Gifford; *Treasurer*, M. W. Bishop; *Secretary*, J. R. Vernon; *Board of Governors*, I. J. Haus, C. W. Miller, and H. W. Schreiber. Mr. Bishop spoke of the untimely passing of W. A. Russell, second vice-president of the Society. Attendance, 48.

Note: The attendance ratios shown above represent the meeting attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be helpful in deciding on subjects for chapter meetings.

NEW YORK CHAPTER GOLF MEET

New York Chapter closed its 1944-45 season with an all-day Golf Meet for members and guests at the Scarsdale Golf Club, Hartsdale, N. Y., June 20.

The arrangements were made by a special committee, A. F. Hinrichsen, chairman, H. S. Johnson, and F. D. Lawrence. At the close of a day of strenuous competition, other members of the Chapter joined the golfers in a dinner at which the newly elected Chapter president, Harold J. Ryan, presided. Chairman Hinrichsen presented a tribute to the members in the Armed Forces at the beginning of the dinner. At the close of the dinner he announced awards to the following golfers for excellence in performance: Alfred Engle, members' low net score and tee shot nearest pin on ninth hole; George C. Cummings, members' high score; Howard Smart, guest low net score; and Ted Hart, low gross.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 23 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by August 15, 1945, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
BEKESHUS, JOHN H., Devlpt. Engr., York-Shipley, Inc., York, Pa.	J. J. Mirabile E. R. Walsh, Jr.	*G. D. Frank *C. H. Neiman, Jr.
BONDE, IRA E., Ind. Design Sect., U. S. Navy Yard, % FPO, San Francisco, Calif.	G. E. Williams F. M. Brewer	K. E. Beisel L. B. Burney
CHRISTIERSON, CARL A., Mgr., Air Conditioning & Engineering Co., Durban, South Africa. *(Advancement)*	R. J. S. Caldwell Jacob Ehlers	S. H. Overton Earl Carrier
DOWNING, CLAIRE A., Research Engr., Vermiculite Research Institute, Evanston, Ill.	T. H. Coulter C. F. Boester	C. M. Burnam, Jr. C. E. Price
DRING, ROBERT W., Todd & Brown, Inc., LaPorte, Ind.	J. H. Schrock W. C. Bevington	Henry Mathis W. T. Miller
HADLEY, LAWRENCE G., Apprentice Engr., Young, Austen & Young, Ltd., London, England.	W. L. Swain *A. H. Harwood	*E. E. Austen *J. A. Speedyman
HAGEN, ROSCOE T., Maintenance Engr., The Perfect Circle Co., Hagerstown, Ind.	W. C. Bevington G. B. Supple	G. O. Jackson S. E. Fenstermaker
JOHNSON, WILLIAM A., Distributor for Barber-Colman Co., and Preferred Utilities Manufacturing Corp., New Haven, Conn.	D. M. Hummel L. A. Teasdale	Winfield Roeder T. J. Converse
KINDLER, SIDNEY, Gen. Mgr., Matthew Hall & Co., Ltd., London, England.	*Bertram Baden W. G. Case	*A. C. Mackadam *R. S. C. Chempers
LUEDECKE, WILLIAM H., Application Engr., Westinghouse Electric Corp., Dallas, Tex.	L. G. Huggins W. A. Minkler	J. J. Tillotson H. S. Haynes
MARKS, ALEXANDER A., Director of Research, Richmond Radiator Co., Uniontown, Pa. *(Advancement)*	A. H. Schroth H. J. Kirkendall	C. H. Flink E. H. Riesmeyer, Jr.
OSTERHAGE, CATHERINE SWEENEY, Draftsman, E. I. du Pont de Nemours & Co., Inc., Richland, Wash.	J. M. Musser E. T. P. Ellingson	*C. H. Storms *William Dunnington
PONS, RAYMOND A., Partner and Mgr., Pons & Davis, Salt Lake City, Utah.	R. C. Brown G. C. Campbell	H. G. Richardson E. V. Gritton
ROYCE, ROBERT F., Lakeside, Mich.	Axel Marin C. F. Kessler	R. S. Hawley R. C. Porter
SANTI, KARL E., Mech. Engr., Navy Yard, Pearl Harbor, Hawaii.	G. E. Williams F. M. Brewer	K.E. Beisel L. B. Burney
SCHAEFER, ARMAND, Dist. Mgr., Iron Fireman Manufacturing Co., Chicago, Ill.	J. B. Hashagen J. J. Philippi	M. F. Mattingly O. G. Ward
SCHOTT, FREDERICK C., Co-Owner, Atlas-Butler Furnaces, Inc., Columbus, Ohio.	M. M. Swepston A. T. English	W. M. Myler, Jr. Allen Williams
STEVENS, STANLEY A., Engr., Matthew Hall & Co., Ltd., London, England.	*Bertram Baden G. E. Smith	*Charles Porter *D. Rookslay
STOLKER, EDWARD A., Owner, Stolker Engineering Co., Philadelphia, Pa.	N. S. Macfarlan Edwin Elliot	Mortimer Traugott C. E. Bartlett
THOMPSON, ALBERT E., Branch Mgr., Matthew Hall & Co., Ltd., London, England.	*Bertram Baden G. E. Smith	*M. Vincent *A. C. Mackadam
THOMPSON, HAROLD D., Foreman, Naval Aviation Supply Depot, Philadelphia, Pa.	A. C. Caldwell E. K. Wagner	*E. D. Foster *W. J. Nowinski
VARELA, JACOBO A., Principal, Jacobo A. Varela-Ingeniero, Montevideo, Uruguay.	*Santiago Mauri *Salvador Masson	*John Carr *Agustin Maggi
WARREN, G. RICHARD, Mech. Engr., North American Aviation, Inc., Kansas City, Kans.	P. C. Leffel L. P. Heaven	D. M. Allen R. B. Mason

*Non-member.

Candidates Elected

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

BERNER, IRA L., Mgr., Tech. Sales & Serv. Dept., The Celotex Corp., Chicago, Ill.

BROKAW, GEORGE K., Htg. & Vtg. Engr., San Francisco, Calif. *(Advancement)*

COSTA, CIRO A., Engr., Westinghouse Electric Internt'l. Co., Buenos Aires, Argentina, S. A.

CREEARS, TOM H., Owner, Los Angeles, Calif.

FRANK, GEORGE D., Mgr. Indus. Div., York-Shipley, Inc., York, Pa.

GETTINGER, EDGAR W., Engr., American Furnace Co., St. Louis, Mo.

GUEST, ROSS B., Owner & Mgr., The Guest Sheet Metal Works, New Orleans, La. *(Advancement)*

JOHNSON, CARL W., Mech. Engr., Mountain States Tel. & Tel. Co., Denver, Colo.

LOCHER, DAVID E., Pres. & Mgr., Coolidge Locher Co., Corpus Christi, Tex.

MASON, RAYMOND P., Engr., U. S. Army Transport Service, Fort Mason, Calif.

MICHAEL, ARTHUR F., Gen. Supvr. Air Cond., Southern California Gas Co., Los Angeles, Calif.

MILNOR, JOE W., Engr., Westinghouse Electric Corp., Atlantn, Ga.

MILTON, TAYLOR, Lt., CEC, USNR, U. S. Naval Air Station, Minneapolis, Minn.

MIRABILE, J. JAMES, Engr., York-Shipley, Inc., York, Pa. *(Advancement)*

MOUNTFORD, RALPH E., Tech. Consult., Ministry of Supply, London, England.

NIEMAN, CHARLES H., Jr., Asst. Dir., York-Shipley, Inc., York, Pa.

OTTUM, ALVIN L., Engr., Glenn L. Martin-Nebraska Co., Omaha, Nebr. *(Advancement)*

PINKERTON, JOHN B., Cons. Engr., Dolby & Williamson, London, England.

RICE, JOHN A., Engr., Charles F. Guyon, Inc., New York, N. Y. *(Reinstatement & Advancement)*

SALINGER, ROBERT J., Mech. Engr., Reg. F. Taylor, Cons. Engr., Houston, Tex. *(Reinstatement & Advancement)*

SNOW, EDWARD E., Chief Des. & Engr., Mellor Bromley & Co., Ltd., Leicester, England.

SPENCER, ROLAND M., Dist. Sales Mgr., The Powers Regulator Co., Chicago, Ill. *(Advancement)*

STILPHEN, NORMAN E., Owner, Stilphen Engineering Co., Sanford, Me.

TRAMBAUER, CHARLES W., Suprvg. Engr., Raisler Corp., New York, N. Y. *(Advancement)*

WESTPHAL, EDWARD R., Mgr. of Plants, Weil-McLain Co., Michigan City, Ind.

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WILLIAMS, H. B., Asst. Chief Engr., McQuay, Inc., Minneapolis, Minn.

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St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, W. J. Oonk, 4548 Red Bud Ave., St. Louis 15. Secretary, W. A. Russell, 1948 N. Ninth St., St. Louis.

South Texas: Organized, 1938. Headquarters, Houston, Tex. Meets, Third Friday. President, J. A. Walsh, P. O. Box 1773, Houston. Secretary, D. M. Mills, Gray & Crawford, Houston 3.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Second Wednesday. President, Maron Kennedy, 5051 Santa Fe Ave., Los Angeles 11. Secretary, R. A. Lowe, 3744 Potomac Ave., Los Angeles 16.

Utah: Organized, 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, H. G. Richardson, 1433 Harvard Ave., Salt Lake City. Secretary, E. V. Gritton, 2470 S. 15th East St., Salt Lake City.

Washington, D. C.: Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, W. H. Littleford, 616 New York Ave., N. W., Washington. Secretary, Lester Maurer, 1835 19th St., N. W., Washington 9.

Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, H. J. Metzger, 137 E. Water St., Kalamazoo. Secretary, H. W. Wolters, 830 Staples Ave., N. W., Kalamazoo 54.

Western New York: Organized, 1919, Headquarters, Buffalo, N. Y. Meets, Second Monday. President, F. A. Moesel, 31 Main St., Buffalo 3. Secretary, J. S. Meyer, 35 Crescent Ave., Buffalo 14.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, O. A. Trostel, Route No. 2, Thiensville. Secretary, J. R. Vernon, 507 E. Michigan St., Milwaukee 2.

Messages from Members in Service

The Officers of the Society have received some interesting correspondence from members in Service and some extracts from their letters are quoted for the information of their fellow members.

From C. M. Barrett, Capt., O.C., 22, L.A.D. Att., R.C.A.—I wish to thank Pres. C.-E. A. Winslow for his expression of greeting and good will in his letter of the 27th of February which has finally come to hand. I have been away from Canada for three and a half years and have been all through the European conflict, so that I too am eagerly looking forward to home. However, I believe, in my capacity as an engineer, I may have to remain in Germany for some little time.

•

From Edgar L. Bernard, Capt., C.E. Hdq. 3rd U. S. Army—President Winslow's letter of February 27th was a pleasure to receive and your letter of June 1st on Employment Opportunities was of great interest. Today, in returning from a trip to Pilsen, my pilot circled our little plane over this city (Munich). The sight of the awful destruction created by our bombers is much more effective from the air and is truly sickening. It makes one hope and pray and wish for the opportunity to return to constructive effort in civilian engineering.

At the present time, I have served over 52 months with the Corps of Engineers, more than sixteen of which have been in the European Theater of Operations. It is anticipated that I may be released from active service with the Army during the first quarter of 1946, or shortly thereafter.

•

From Robert O. Cropper, Major, Hdq., 59th Q.M. Base Depot—Your April 18 memorandum reached me on June 9 at my present location in Manheim, Germany. Censorship now permits us to state where we are located. I am enclosing an envelope to show you what headaches the Army Post Office must have in trying to keep up with us. During the past year I have been in the United States, England, France, Belgium and Germany.

•

From A. W. Wood, F/L, R.C.A.F.—I am enclosing my last address and I want to take this opportunity of saying that your various letters always caught up with me eventually. Would be pleased to know of any opportunities in the field of air conditioning and forced warm air heating. Have the United States and Canadian Governments released much industry to manufacturers of heating equipment?

Thanks for keeping me informed on trends, and may we all meet soon in another full winter session when we can plan our hopes in a peace time America.

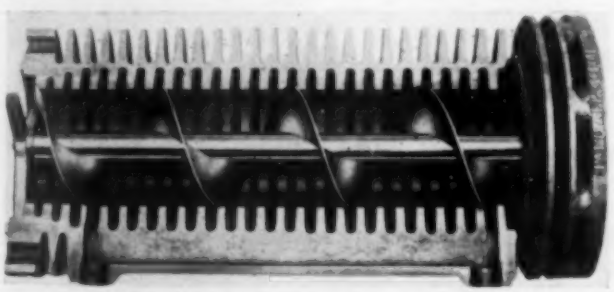
• EQUIPMENT DEVELOPMENTS •

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1945 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Temperature Exchanger for Air and Gas Lines

No. 2846—The Bird-White Co., 3119 W. Lake St., Chicago 12, Ill., has announced the development of a new temperature exchanger based on the principle of heat transfer for air and gas lines and offering as a byproduct external heating applications and positive purification by centrifugal action.

As an after cooler, this unit is recommended by the manufacturer for installation at the compressor discharge point. It is supplied with external and internal cooling fins, and features a multiple action helicoid flighting. The velocity of the element (air or gas) under pressure revolves the helicoid flighting at high speeds forcing the air or gas outward against the internal cooling fins. These internal cooling fins rapidly absorb the heat generated in compression and dissipate this heat to the outside atmosphere through external cooling fins thereby lowering the element to room temperature in the length of the unit. Vaporized moisture and oil suspended in the element condenses and is entrained in the sump.



For accommodating large volumes of air or gas parallel assemblies of the temperature exchanger may be made. The design also permits tandem installation to any required length. The units are available for both flanged and screwed type assemblies and may also be provided for either manual or automatic draining of the sump. In addition to the unit's effectiveness in temperature control, there are many advantages in the utilization of the heat given off by the external cooling fins, says the manufacturer. This new unit is also ideal for assuring positive purification of air or gas lines where temperature control is a factor, it is said.

"Try Before You Buy" Plan

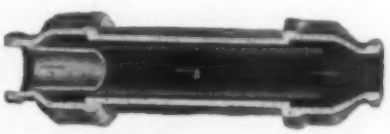
No. 2847—Merchandising of semi-portable room air conditioners, on the familiar "try before you buy" plan utilized by dealers in many smaller appliances, will be tried in the postwar period, according to H. F. Hildreth, manager of the refrigeration specialties department, Electric Appliance Div. of the Westinghouse Electric Corp.

"The moment wartime restrictions relax to the point of permitting us to start the manufacture of 'Mobilaire' room air conditioners, our dealers expect to start putting them into commercial establishments and homes for a small installation fee," Mr. Hildreth said. "If the prospect decides to buy the unit, the installation fee is applied to the cost. If he should decide that he doesn't want the unit after all, the installation fee will help defray the cost of the trial installation."

According to the manufacturer, this unit not only reduces room temperature, but also circulates air, brings in fresh air from outdoors, exhausts stale air from rooms, removes dust and dirt from the air, reduces humidity, and shuts out street noise and dirt.

Check Valve

No. 2848—The "Permatite" check valve, which has no poppets, discs, or other metal working parts, has recently been announced by the Harman Equipment Co., 937 Santa Fe Ave., Los Angeles, Calif. Back flow is checked by a synthetic rubber tubing which offers positive control, since the tubing opens with either vacuum or pressure to permit direct flow, and closes when the flow is stopped.



Valve installations and servicing are simplified, says the manufacturer—no manholes, sleeves, or extractor equipment is required where valves are buried because the tubing is permanently tight and its opening and closing movements are such as to prevent foreign matter from fouling the valve or causing leakage.

It is claimed that this valve can be used with air, natural gas, any commercial liquid including all petro-

Heating, Piping & Air Conditioning, [8-45]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(Circle each number in which you are interested)

2846	2847	2848	2849	2850	2851	2852	2853	2854	2855
2856	2857	2858	2859	2860	2861	2862	2863	2864	2865
2866	2867	2868	2869	2870	2871	2872	2873	2874	2875
2876	2877	2878	2879	2880	2881	2882	2883	2884	2885
2886	2887	2888	2889	2890	2891	2892	2893	2894	2895
2896	2897	2898	2899	2900	2901				
5013	5014	5016	5017	5018	5019	5020	5021	5022	5023
5024	5025	5026	5027	5028	5029	5030	5031	5032	5033
5034	5035	5036	5037	5039	5040	5041	5042	5043	5044
5045	5046	5047	5048	5049	5050	5051			

Name..... Title.....

Company .....

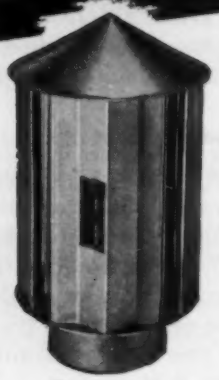
Address .....

City..... Zone..... State.....

Positive Ventilation *without Down-Draft!*

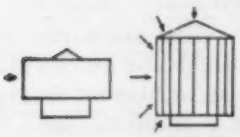
Breidert Air-X-Hauster VENT FLUE CAP

The greatest scientific improvement in Ventilators in over 50 years



Ends annoyance and danger of pilot lights blown out by down-drafts.

No matter which way the wind blows, the revolutionary, aerodynamically correct design of the Breidert Air-X-Hauster enables it to provide safe, sure ventilation. No moving parts ... "back-draft" eliminated where no interior negative pressure exists! • Unlike conventional ventilators, the Breidert has been thoroughly tested (by Smith, Emery & Co., Pacific Coast branch, Pittsburgh Testing Laboratories) with wind blowing at *all* angles, and its capacities *certified.*



Old Method — Breidert Method

THE ANSWER TO GAS HEATER PROBLEMS ... The Breidert does not have the defects of conventional types of caps and accessories. It eliminates the necessity for down-draft diverters, with accompanying dangers of explosion in case unburned gas accumulates or is blown into the room.

Breidert Air-X-Hausters for Roofs and Chimney Tops

There is a Breidert Air-X-Hauster for practically every home, commercial and industrial ventilating problem. Thousands are successfully in use in all parts of the country.

TYPE A — TYPE B — CHIMNEY TOPS

WRITE FOR FREE ENGINEERING DATA BOOK ... contains specifications and installation data, certified capacity ratings, etc. Address Dept. S

G. C. BREIDERT CO.

634 South Spring Street, Los Angeles 14, California

REPRESENTATIVES LOCATED IN PRINCIPAL CITIES OF THE U. S.

leum products from crude oil to liquified petroleum gases, hot or cold water, and any chemical that will not attack synthetic rubber. According to the manufacturer, the valve may be used as a foot valve, vertical, horizontal, or angle valve in any suction or discharge line. Working pressures up to 125 psi in ½, ¾, and 1 in. sizes are available.

Lightweight Fan Motor

No. 2849—A new lightweight fan motor for use with high capacity blowers has been announced by the Bogue Electric Co., 37 Kentucky Ave., Paterson 3, N. J. Aluminum construction is used throughout, and sealed bearings which require little servicing. The motor is designed for 24 volt operation on direct current, but it can be adapted for any specification and delivers 2 hp, it is said. It is self ventilated and will operate continually in any position in high ambient temperatures, says the manufacturer. By mounting the motor directly on the blower housing one end shield is eliminated.

Pressure Shaft and Expansion Bellows

No. 2850**—For use as pressure shaft seals and as volume expansion compensators, the Autoflight Instrument Div., G. M. Giannini & Co., Inc., 161 E. California Ave., Pasadena 5, Calif., has announced "Autoflight Controlled Action" bellows. The bellows are assembled from matched diaphragms, sealed gas and liquid tight by brazing, with sealing rings swaged on the inner and outer diameters for maximum mechanical strength, says the manufacturer. Relative movement being confined to the diaphragm convolutions, no flexure occurs at the seals, and hence no leakage or fatigue is possible, it is said. The bellows can be engineered to specifications from stainless steel, phosphorous-bronze, beryllium copper, or special alloys.

Sales Talent Selection

No. 2851—The Bryant Heater Co., 17825 St. Clair Ave., Cleveland 10, Ohio, has undertaken to aid gas companies, distributors, and dealers to select competent gas heating salesmen postwar by engaging the personnel research institute of Western Reserve University to prepare special selection procedures.

The sales talent indicator test is the heart of the resulting S.T.I. plan evaluated and standardized on, and for, gas heating salesmen in particular. Although not an infallible hiring guide, the plan is based on five

NO 2

Tubing Topics . . .

PROGRESS REPORT ABOUT "WELD-ON" FINNED TUBING AND TILCO FIN

by EXTENDED SURFACE

Division of DAVID E. KENNEDY, INC. 68 Second Ave., Brooklyn 15, N.Y.

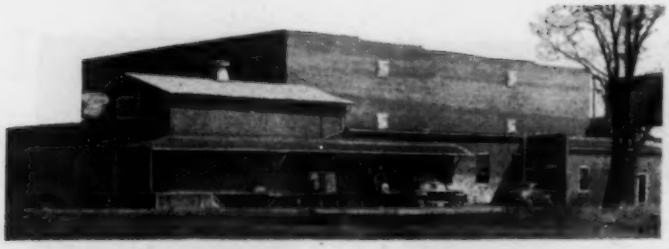
Complete specialization and intense concentration usually produce a better product and a better service. "Extended Surface" devotes ALL its efforts to the manufacture of finned tubing in straight lengths only —and the economical solving of our customers' problems. Furthermore, the design of Tilco Fin tubing and the method of its production also provide several unique advantages. For instance, Tilco Fin tubes of any size from ⅜" to 1¼" can be finned at any fin spacing without making special costly dies. Yet this is but one reason why we have often been able to help when advanced designing has been held up by the lack of the proper finned surface. We may be able to help you. Investigate by sending for the informative Tilco Fin folder or ask us for samples or any specific information —without obligating yourself in any way, of course.

FINS WELDED TO TUBES AT SHOULDERS

TILCO-FIN EXTENDED SURFACE TUBING FOR *Dual Efficiency*

HIGH HEAT TRANSFER
Segmented fin provides extremely high heat transfer factor.

LOW RESISTANCE
Tilco-Fin design offers much less resistance to the passage of air than accepted standards.

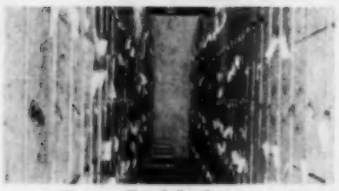


How this plant serves a town of 2,500 as a Community Refrigeration Center

Ice Manufacturing and Delivery

Fruit Packing and Storage

Freezer Storage



Frozen Food Lockers

An ice plant of only 10 tons capacity a few years ago, the Greencastle (Pa.) Ice and Cold Storage now handles up to 80 tons daily, sells ice refrigerators, supplies farmers with ice for cooling milk, chills 600 tons of cherries in ice water before pitting, ices many refrigerator cars.

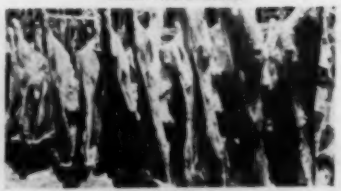
It stores 100,000 bushels of apples, and freezes big hogsheads of peaches and berries, all from its own packing house.

Meats, poultry, vegetables, and cream are frozen and stored. Twelve hundred refrigerated lockers are rented. Fresh-killed calves and sheep (4000 per month) are chilled before being shipped.

The ice cream bar sells lunches; a cold room serves as a milk substation; beer was formerly handled at wholesale. Quick-freezing of locally grown foods in great quantity is the next step.

We believe every progressive town can profit, in the postwar world, from a COMMUNITY REFRIGERATION CENTER. You are welcome to make use of the consulting-engineering service and equipment we offer for this program. Address

Milk Substation



Meat Chilling

Ice Cream Bar

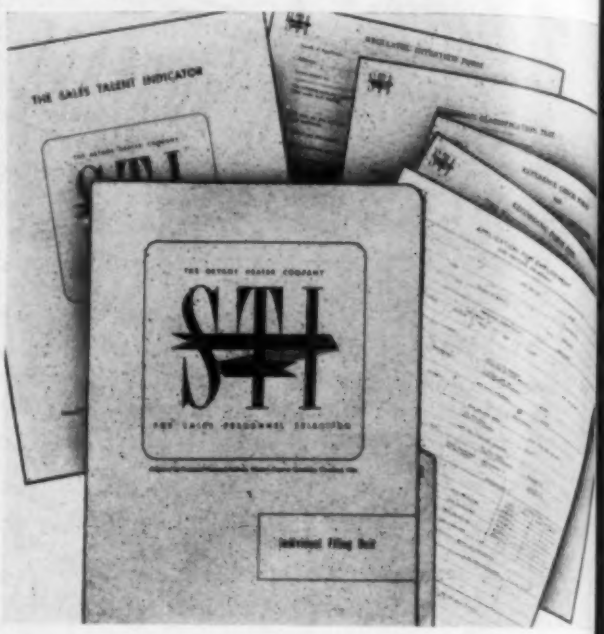
BUENA REFRIGERACION DESDE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

major analyses of the applicant's capabilities, and check studies have shown that 82 per cent of salesmen thus chosen will be above the average of men employed through methods now commonly used.

Of these five analyses, the most useful is the sales talent indicator test, which was constructed by applying a number of standard psychological tests to some 200 gas heating salesmen divided into groups of 100 men each. Members of the first group were men with top selling records in the gas heating field, while the other group was made up of men whose sales work was known to be below par.



Selected questions which elicited uniform answers from the top group and contrary answers from the bottom group permit the interviewer to assemble a fairly complete personality portrait of the applicant. If this portrait is markedly similar to the composite test picture of men known to be successful gas heating salesmen, the applicant will probably enjoy a similar success. Applicants who respond in conformity with the below-average sales group are equally likely to prove unsatisfactory as salesmen.

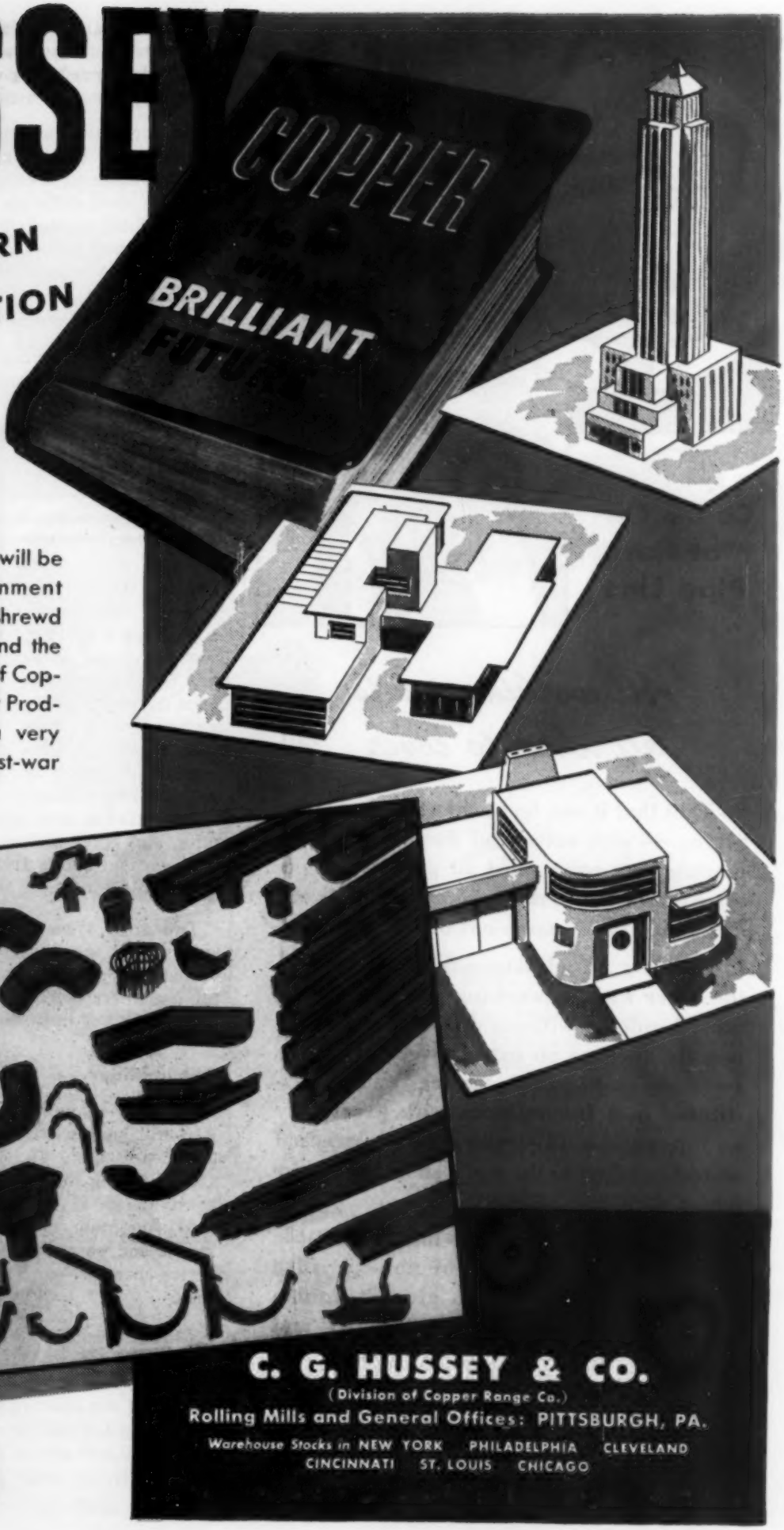
An individual filing unit for each applicant includes, in addition to the sales talent indicator test, four other significant analyses. These are a weighted application blank, a regulated interview form, a salesman classification test (a test of intelligence), and a mechanical aptitude test which may be required of salesmen who are expected to do their own engineering. A manual is also provided for the instruction and use of those charged with the interviewing of gas heating salesmen, and for administering and scoring the tests.

Potentiometer Controllers

No. 2852—A new series of electric type potentiometer controllers has been announced by the Bristol Co., P. O. Box 1790, Waterbury 91, Conn. Five basic control unit types are available. Three are electric contact types (known as "Microact" controllers) and the other two are electric proportioning and current input types. The

HUSSEY

. . . in MODERN CONSTRUCTION



With the dawn of peace—a million new homes will be needed annually —over eighteen million will be modernized. Government agencies, banks and shrewd home-buyers will demand the lifetime dependability of Copper, and Hussey Copper Products will be playing a very important role in this post-war construction era.

C. G. HUSSEY & CO.
(Division of Copper Range Co.)
Rolling Mills and General Offices: PITTSBURGH, PA.
Warehouse Stocks in NEW YORK PHILADELPHIA CLEVELAND
CINCINNATI ST. LOUIS CHICAGO

HUSSEY

All working parts attached to cover

So light that it can be borne entirely by the piping — with valve and float mechanism mounted on cover, and all piping connections on the body, the Adsco Vertical Steam Trap need never come out of the pipe line.

If cleaning or adjustments are necessary the cover with all working parts can be removed quickly without disturbing the piping. By keeping an extra cover with valve assembly on hand this "spare" can be substituted in a few minutes with practically no interruption to service, and the original assembly taken to the work shop for servicing.

Double Life. **This trap also has a reversible valve and reversible seat of non-corrosive stainless alloy steel which gives it double life. Write for Bulletin No. 35-86HP and prices.**

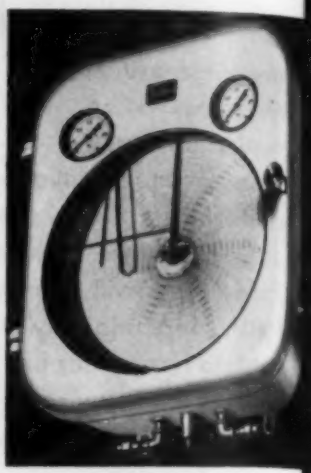
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 65 Years

control units are mounted on the internal panel of potentiometer recorder and any type may be converted to any other type by following wiring and mounting instructions, says the manufacturer.

The three electric contact types are provided with one, two, and three toggle switches respectively, and with six different terminal board connection arrangements to meet differing control circuit requirements. Proportioning controllers may be used with any type of electric proportioning valve, it is said, and may be had with resetting contacts if required.

Controlling Thermometer

No. 2853—To maintain steady states of internal balance, the Gotham Instrument Co., 149 Wooster St., New York 12, N. Y., has announced the "Gotham" air operated recorder controller. This device, says the manufacturer, combining distinctive control features with the inherent characteristics of mercury, vapor, and gas actuated thermal systems, helps to maintain this control level within close limits of temperature variation by an accurate equilibrium between heat supply, heat losses, heat transfer rates, and other factors. No retard action is involved in operation, and a free suspension movement is said to assure pivot center and no change in time line.



Two other types offered by the same manufacturer are a direct set controller which features a fully calibrated dial, and a non-indicating controller designed for use where extremely close control is necessary, but where it is not important to have a record.

Dehumidifier

No. 2854—A new dehumidifier, known as the "Water Sorber," has recently been announced by the General Air Conditioning Co., 4415 Appleton St., Cincinnati 9, Ohio. Among the features of this device is a terraced construction, in which three receptacles arranged one below the other catch the residue liquid in descending stages and permit this liquid—which also contains an active chemical—to continue to absorb additional moisture.

Chemical cubes used as an absorbent present more exposed surfaces and a greater absorption area to the moist air, says the manufacturer. Air which enters the bottom of the cube container through perforations provides uniform and thorough melting of the cubes. A single unit will service from 800 to 1000 cu ft, it is said, and for larger areas two, three, or more units may be used.

RETAILERS WINNING *Double Header*

Foresighted American retailers are out to better their *bond-selling* record with a higher bond buying average. Improve your payroll savings plan now!

Here's Why:

- Helps curb inflation
- Builds a larger future market for your goods
- Inspires employees to sell more Bonds. The best salesman is sold on his product.

Here's How:

Through personal contact ask every employee to sign up for regular payroll savings each week. Keep it up until you get at least 90% participation and 10% of payroll applied to the purchase of War Bonds.

OUTSTANDING RETAILERS PROVE IT:

	% *employees participating*	% *total payroll savings*
Department store	**98.**	**10.5**
Clothing store	**100.**	**10.0**
Food store	**91.**	**10.1**
Drug store	**94.**	**10.3**
Specialty store	**90.**	**10.0**

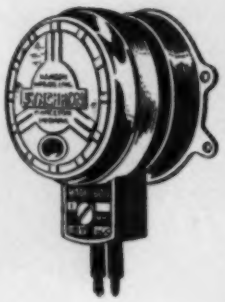
The Treasury Department acknowledges with appreciation the publication of this message by

HEATING, PIPING & AIR CONDITIONING

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council

—available SOON!

—THESE
TIME-TESTED
SYNCHRONOUS
SELF-STARTING
SELF-LUBRICATING
MINIATURE—

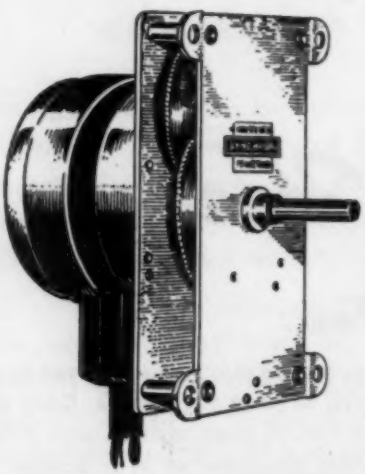


SYNCHRON

TIMING MOTORS

AND

TIME MACHINES



● If you manufacture timing devices and plan soon to go into production, get all the facts now on these "tiny timers."

● SYNCHRON Motors are compactly built, with rotor and coil nested in a sturdy, streamlined case only 2 3/4" x 1 5/16". These motors have power to pull 8 oz. direct load continuously at 1 RPM, and they are pre-tested to operate at 40 degrees below zero or 140 above.

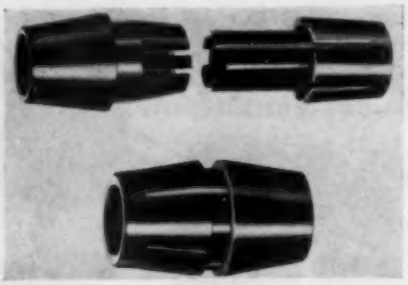
● SYNCHRON Timing Machines—powered by SYNCHRON Motors—are accurate, long-wearing, and easy to mount. They operate at standard intervals of 1 RPM, 1 RPH, 1 RP12H, and 1 RPD.

Write for SYNCHRON Catalog, complete with engineering data.

HANSEN MANUFACTURING CO., Inc.
Princeton 6, Indiana

Plastic Grommet

No. 2855**—For insulation and protection of cables and lines passing through bulkheads of ships and aircraft, and for hundreds of applications of electrical insulation, the non-inflammable plastic blind "Des-Grommet" produced by the Victory Mfg. Co., 1105 S. Fair Oaks Ave., So. Pasadena, Calif., offers many advantages, the manufacturer says.

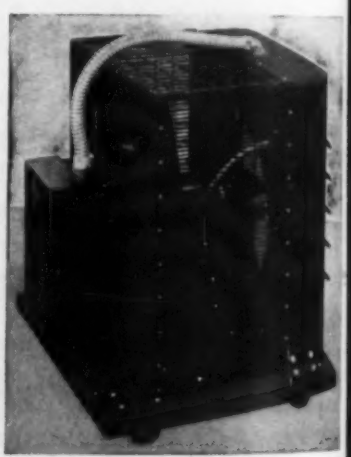


The grommet is composed of two parts molded from a non-inflammable formula. The two parts are so designed that they may be applied from one side only by means of a special tool. To install the grommet, it is slipped onto the tool and thrust through a hole in the partition. As the grommet is drawn together, an undercut section on one half is engaged with a spring locking section on the other. The tool then forces the two sections together, locking them into one integral unit at the point at which the partition stops further movement.

These grommets are furnished in sizes to accommodate cables and tubes from ¼ through 2 in. in diameter. Two sizes for wall thickness are supplied, one to accommodate ⅛ to ½ in. and the second for bulkheads ½ to 1 in. in thickness.

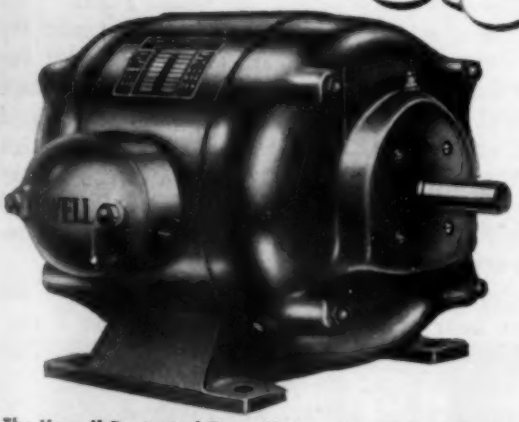
Portable Air Heaters

No. 2856—For supplying heat at any location or in extra amounts occasionally, new portable model heaters have been announced by the Electromode Corp., Division of the American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind. These unit heaters were designed originally for the heating of emergency huts used to protect men working outdoors at a steel plant. Heater elements, fan motor, contactor, and switch are all mounted on one base provided with casters for easy mobility. Rectangular heater elements consisting of sheathed resistors cast in one piece aluminum casting are used in the 20 kw heater shown.



A-c and D-c Welding Electrode

No. 2857—A newly devised flux coating that makes it suitable for either a-c or d-c welding features "Eutec-Trode 28," an arc welding electrode recently introduced by the Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y. It is designed for welding bronze, brass, and copper.



The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. *Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.*

It has come to this— but we haven't cut Howell Quality

Yes, many of those good dependable Howell Motors have been shipped by air express to those who vitally need them for the war effort. The delivery situation in the entire electric motor industry is just this serious.

But we haven't cut Howell quality in any way. Prewar standards are being rigidly maintained without any compromise whatsoever in quality.

It's to your advantage to bear with us! We recognize our obligation fully and are putting forth our maximum efforts to build more and more motors, and to see that they are distributed among users whose needs are most vital.

HOWELL ELECTRIC MOTORS COMPANY

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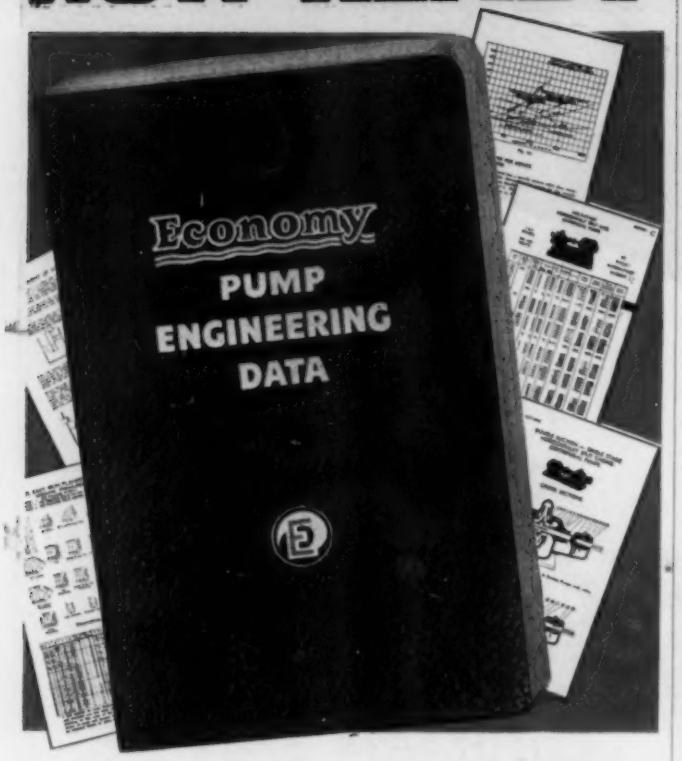

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A timely contribution to the pump industry—416 pages of factual data just when vital postwar problems require authentic facts, sound experience and advanced engineering practice.

Here, under one cover, are hundreds of handy tables and diagrams you need every day. Revised, improved and new data governing the correct layout and installation of sewage, drainage, processing, heating systems, etc. Describes clearly and exactly the way to do the job right.

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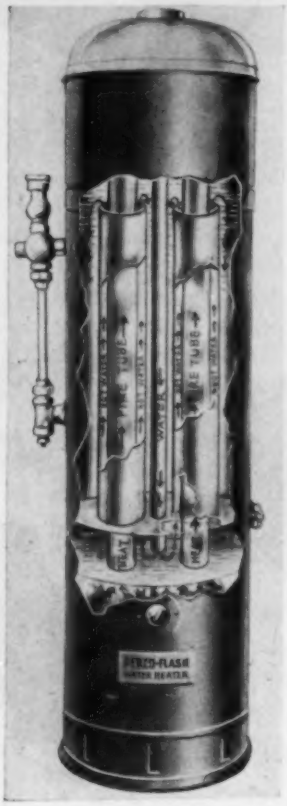
ECONOMY PUMPS, INC.
HAMILTON, OHIO • U. S. A.

This electrode will deposit dense and tough metal that is a good color match to most types of bronzes and will also give the welded area substantially the same corrosion resistance as these various base metals possess, says the manufacturer. It may be used for joining copper and brass to steel, cast iron, or nickel alloys, and for overlaying steel or cast iron to provide a good bearing surface. It is available in ⅛ and ⅜ in. diameters.

Percolation Principle in Heater

No. 2858—A new water heater has been developed by Kresno-Stamm Mfg. Co., 730 Sixth Ave., New York 10, N. Y., which offers many design advantages reflected in fast, economical water heating, says the manufacturer.



Known as the "Kresno Perco-Flash" water heater, this unit achieves speedy water heating on the percolation principle. As the cutaway view shows, a stream of water flows downward through the center of the heater, striking the fire plate just above the combustion chamber. It splashes, partially vaporizes, and instantly rises into the space between the concentric vertical inner and outer tubes. The inner tubes serve as fire tubes which carry the hot products of combustion. As only a small quantity of water can percolate up this narrow space, it quickly absorbs the heat radiated from the fire tubes and spills over into the hot water reservoir or storage chamber. A portion of this hot water is recirculated into the cold water supply chamber above, thereby further reducing heating-up time. This high speed movement of water minimizes the tendency for lime or salts to deposit and prevents clogging or corrosion, the maker states.

Absorption of a large percentage of the heat from the fire tubes causes the temperature of the expanded flue gases and the quantity of heat losses through the stack to be lowered appreciably, the manufacturer says. Rapid heating of small quantities of water to a relatively high temperature rise (110 F) means less water needs to be heated, less time is required for heating, and less fuel is consumed to provide the quantity of hot water required.

The oil burning units are rated at 32, 100, and 150 gallons per hour of hot water recovery at 110 F rise, with additional capacity (when connected to a storage tank) of 100, 280, and 400 gallons, respectively.

Gas burning water heaters are rated at 28 and 85 gallons per hour recovery at 110 F rise with additional storage capacity of 80 and 230 gallons, respectively.

Air Control for Pumps

No. 2859—The Electro-Mechanical Div. of Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn., has an-

nounced a new "Ashcroft" air control for shallow well

To obtain the desired welding speed, says the

For leak-proof joints of full pipe strength that cost less, use stock WeldOlet Fittings on pipe sizes from ¼" to 12".

● You'll save time with WeldOlet Fittings as the branch pipe does not have to be formed and fitted to the run pipe. Stock WeldOlet Fittings are available in size-to-size or reducing sizes from ¼" to 12" . . . to meet every branch piping need.

And there are other savings when you use WeldOlet Fittings! No templates are needed and reinforcing is unnecessary. WeldOlets reduce the welding time needed to make an outlet. Three types are available, for butt-welded, socket-welded or screwed outlets.

Find out now how the WeldOlet Method will help you save time and money on your next branch pipe outlet job. Drop us a line today.

How to Make Outlets in Four Easy Steps

This new "Handbook of Branch Pipe Outlets" gives you all the information you need to make strong branch pipe outlets faster. With it, your men can speed fabrication and at the same time get better results on each job. For your copy, just send us a request on your company letterhead. The "Handbook of Branch Pipe Outlets" will be put in the mail for you.

***Forged Fittings Division* · BONNEY FORGE & TOOL WORKS**
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PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

nounced a new "Ashcroft" air control for shallow well pumps which features a rubber diaphragm as the one moving part, combining valve head, gland seal, and float hinge. The valve has a stainless steel orifice and is completely sealed. The body is either cast brass or cast iron.

Welding Positioner

No. 2860**—A new design in powered welding positioners has been introduced by the Standard Machinery Co., Providence, R. I., for rotating work up to 700 lb at speeds from 0 to 2.4 rpm in either direction by hand control. The unit will accommodate table speeds up to 180 in. per min with a work radius of 1 ft. Linear speeds at all radii are set and indicated on a scale located on the side of frame.

To obtain the desired welding speed, says the manufacturer, it is only necessary for the operator to note the approximate radius at which the welding is to be done and to move the control wheel until the indicator is opposite the desired welding speed in the scale column for that radius. For sequence or step welding the table may be positively started, stopped, or reversed.

The positioner is provided with a variable speed transmission and hydraulic cylinder for definite power control with a single ½ hp electric motor. The table is tilted by means of a hydraulic cylinder and gear segments. Oil pressure is developed by utilizing the gears that synchronize the disc drive rolls of the transmission. When not required for tilting, oil from the pump flows continuously at reduced pressure to lubricate the drive roll shaft bearings. Tilting of the table through 135 deg from the horizontal is controlled by a spring centered handle which the operator moves through an angle of approximately 45 deg in the direction of the desired table movement. Automatic limit stops are provided.

Paint Adhesion to Aluminum

No. 2861—Aluminum and its alloys can now be easily, quickly and economically prepared for painting and lacquering with excellent adhesion and corrosion resistance qualities, says the Technical Processes Div. of Colonial Alloys Co., E. Somerset, Trenton Ave., and Reading R. R., Philadelphia, Pa.

The application of this surface preparation can be done either in the shop as a hot immersion process or

(*Continued on page* 150)

For Successful Gas Boiler Installations . . . get this new "Facts and Figures" Bulletin on Climatrol Boiler by Mueller

Here is complete information on the new Mueller Climatrol gas boiler line — consisting of types 10 and 11 for residences and smaller commercial installations, and type 20 for larger residences, apartments, stores, commercial and industrial buildings, etc. Restyled for more attractive appearance, re-designed for the utmost in performance, these units include an entirely new burner design which is extremely quiet in operation. The new Climatrol series provides a complete line of gas-fired boilers with an even greater range of sizes than in the former Mueller series which has been manufactured since the earliest days of gas heating production. Get complete facts now. Ask for Bulletin No. F-320.

L. J. Mueller Furnace Company, 2007 West Oklahoma Avenue, Milwaukee 7, Wisconsin.

Climatrol
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E-17

NO WONDER WINKLER OWNERS ARE ENTHUSIASTIC BOOSTERS

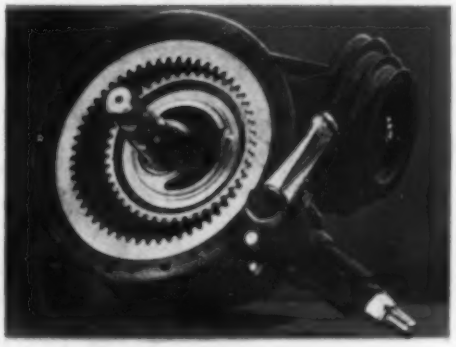
The ultimate test of any product is what its users think about it. The following letter is a typical expression of owner satisfaction with Winkler efficiency and performance:

"The city, in enforcing a smoke ordinance, made it necessary for us to find some method of eliminating this nuisance from our apartment building. We investigated the use of stokers and after looking at several makes in operation, we could see that the Winkler Stoker was really doing the job, at the same time saving Winkler users a lot of money by reducing coal consumption.

"We purchased a Winkler Stoker from your distributor and he installed it in our boiler. Since this installation, we have had no smoke and the heat is more even than we have ever had in our apartment building. At the same time, we have reduced our coal consumption from 321 to 241 tons, a saving of 80 tons.

"We have half as much ash and there is no dust from it. Our firemen have 6½ hours each day to help in the maintenance of the building. Also the Winkler Stoker is helping us with our share in National Defense by relieving the railroads from hauling as much coal as was previously necessary."

You have only to make a casual examination of a Winkler to see that it is an outstanding combination of creative engineering, precision workmanship and brute strength . . . capable of fully developing the inherent economies of stoker-firing. Your request for further information on the construction and performance of Winkler Stokers will receive prompt attention.



FULLY AUTOMATIC TRANSMISSION—
NO SHEAR PIN!

The Winkler "Inter-plan" Transmission is one of many features which enable Winkler Stokers *to give service without needing it*. Its *extra power* design overcomes ordinary operating hazards. Its Automatic Safety Release protects against damage caused by a blocked feed screw. That's why the Winkler Fully Automatic Transmission is guaranteed for three years.

WINKLER

fully automatic STOKERS

U. S. MACHINE CORPORATION • Dept. F-4 • LEBANON, IND.

TWIN RAIL FAN BASE IS LATEST ADDITION to KORFUND VIBRATION CONTROL

The TWIN RAIL FAN BASE offers the following advantages:

1. Simplicity of erection and installation.
2. Adjustable fan and motor fastenings.
3. Adjustable Motor Rails.
4. Interchangeable prefabricated parts.
5. Great rigidity to Lateral and Longitudinal stresses.
6. Light weight.
7. Adjustability of Isolators for correct Load Distribution.
8. Choice of Isolators—Rubber-in-shear Cork, or Steel Springs.

Write for descriptive literature or for a quotation

THE KORFUND COMPANY, INC.
48-36 Thirty-second Place, Long Island City 1, N.Y.
Representatives in Principal Cities

KORFUND VIBRATION CONTROL

KORFUND TWIN RAIL FAN BASE WITH CORK INSULATORS.

(*Continued from page* 146)

in the field as a cold spray, brush or immersion. The hot immersion method consists of dipping the work for three to 30 min in a hot chemical solution, then rinsing and drying, after which it is ready for painting or lacquering. The cold spray, brush, or immersion method consists of applying a chemical solution (at room temperature) by spray, brush, or immersion, allowing from 15 sec to 1 min for setting, then rinsing the surfaces free of the applied solution. The work is then dried and is ready for painting or lacquering.

The cold method is of special interest since it can be applied to aluminum already assembled in the field or in place, such as in store fronts, escalators, etc.

Stick Form Joint Compound

No. 2862**—"Pipetite-Stik" pipe joint compound in handy stick form has recently been announced by the Lake Chemical Co., 607 N. Western Ave., Chicago 12, Ill. Encased in a cardboard holder, the stick may be carried around in a pocket or tool kit. This compound completely seals pipe joint threads and many other threaded units, says the manufacturer, and is unaffected by air, water, steam, acid, gas, brine, etc.

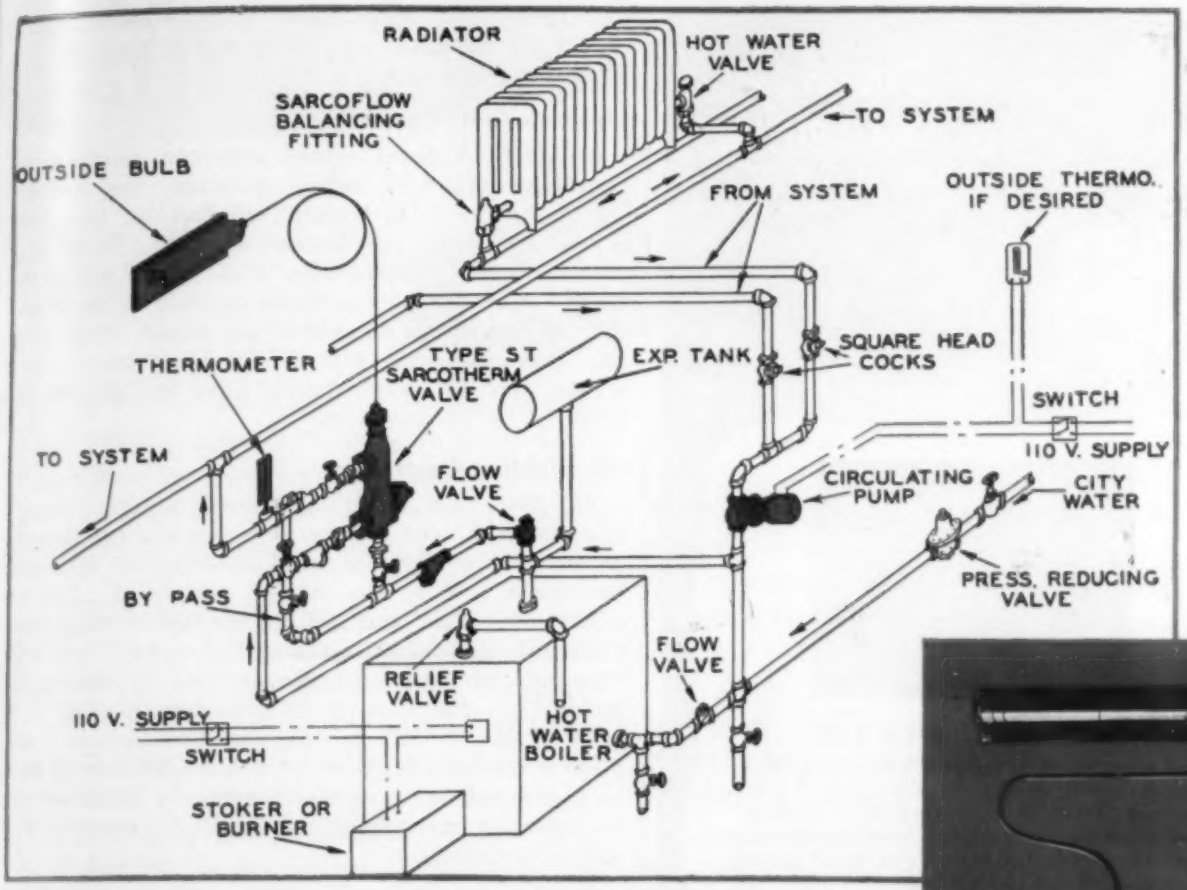
Oil and Rust Preventive

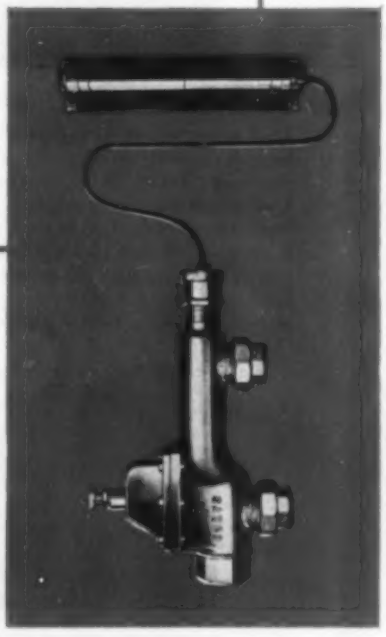
No. 2863**—The Hood Refining Co., 182 N. Hamilton Ave., Greensburg, Pa., has announced "Gibraltar Rad-Treat," a compounded oil and rust preventive which emulsifies quickly with water or any anti-freeze. According to the manufacturer, it is not a solvent but will keep radiators, water jackets and cooling systems clean and will prevent rust and corrosion. It is claimed that this product is not harmful to any metal and will not attack rubber. To avoid clogged cooling systems, the manufacturer recommends that it be used in the proportion of 8 oz to each radiator in car or truck, or approximately 8 oz to each 5 gal of water or antifreeze.

Largest Refrigerating Unit

No. 2864—The largest single refrigerating unit in the world is helping to turn out butadiene synthetic rubber at Lake Charles, La. This system, which uses waste heat from the refinery to produce cold, was designed by the York Corp., Roosevelt Ave., York, Pa.

Raw materials for the butadiene process flow into the plant at an average temperature of 110 F and must be chilled to an average of 10 to 15 F in the refining operation. It is also necessary to reduce the heat of raw materials and byproducts to an average of 55 F for handling and storage en route to other processing plants. Waste heat plus ammonia and water are the principal elements for creating cold in this system. The mixture is heated in a generator boiling off ammonia gas at high pressure. This ammonia gas passes into a condenser, where it is condensed by cooling into a





SARCOTHERM

WEATHER-CONTROL

Now a Packaged Unit

Sarcotherm is a fully automatic mechanical system that assures:

Continuous circulation of heating medium at correct temperatures.

Uniform room temperatures under all weather conditions.

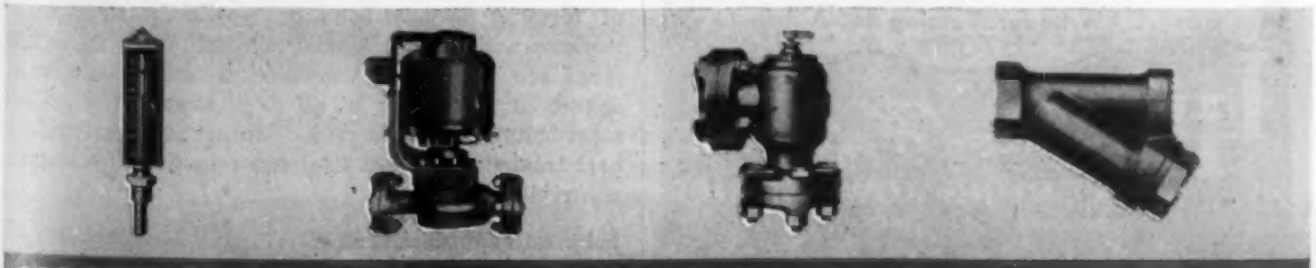
Large fuel savings by preventing overheating in mild weather.

Substantial savings in first cost of installation as higher water temperatures can be used in the design, permitting smaller radiators and pipes.

Less strain on boiler because it is operated at constant water temperature.

Consisting of-

1. The Sarcotherm control valve, type ST with outside thermostat and 40 ft. of flexible connecting tubing.
2. B & G circulating pump of ample size, direct-connected, motor driven.
3. A good hot water thermometer to show temperature of water system.
4. B & G flow valve to prevent reverse circulation when no heat is required.
5. Sarco type SB strainer to protect the control valve from dirt or scale in the water.



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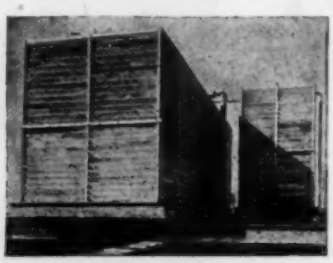
ATMOSPHERIC DECK TYPE

Decks spaced either 2 or 2½ ft. apart. Deck boards in removable grids of 2 layers of 4 in. members, which fit in place in 4" deck supports. Louvres consist of 1 x 6 sheathing boards made into panels, which slide into grooves of louvre support. *No nails or bolts; positive insurance against warping or buckling.* Efficient drift baffles installed inside louvres prevents loss of entrained water under high wind pressures.



ATMOSPHERIC SPRAY TYPE

Amount of cooling this type tower can do is limited to poorer efficiencies, where close approach to wet bulb is not necessary.

Generally offered in smaller capacities, but range in sizes up to 3000 GPM or more.

Water is distributed by galvanized pipe header with smaller lateral arms, equipped with non-clogging spray nozzles. Break-up of water accomplished by atomizing as finely as possible. Towers are rigidly braced and tied together to prevent warping and buckling; withstand wind velocities up to 100 miles per hour without guy lines.

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Lilie-Hoffmann

COOLING TOWERS, INC.

Manufacturers of All Types of Water Cooling Towers

GENERAL OFFICE 4239 DUNCAN AVE., ST. LOUIS 10, MO.
PLANTS AT ST. LOUIS MO. AND PLAINVIEW, TEXAS

high pressure ammonia liquid. In the evaporator unit this liquid ammonia evaporates and absorbs heat to produce refrigeration.

Direct Connect Coupling

No. 2865—A direct connect aluminum coupling, designed for use in all testing operations, has been developed by the E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23, Calif. It fits over the end of any standard type "AND 10056" nipple, the "dogs" of the coupling gripping securely in the undercut just behind the threads of the nipple. Connecting any fluid or air line with this coupling takes only a second, says the manufacturer. Sizes available are ¼, 5/16, ⅜, ½, ⅝, and ¾ in.

Arc Welding Electrodes

No. 2866—A-c nickel manganese, a-c "mo mang" manganese, X2 and X3 electrodes are new additions to its arc welding electrode line, Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., has recently announced. The a-c nickel manganese and the a-c mo mang manganese have wide application in the mining, cement, and railroad industries for repair and building of worn equipment. Characteristics of the weld deposit allow it to work-harden to 550 Brinell, the manufacturer says. Hard surfacing electrodes X2 and X3 are used to protect parts subject to extensive wear, the X2 for severe abrasion and mild impact and the X3 for severe impact and mild abrasion.

Radius Brake

No. 2867—The "Di-Acro" radius brake, a machine for forming duraluminum, chrome molybdenum, rust resistant and spring tempered alloys, and other low ductile materials, has recently been announced by the O'Neil Irwin Mfg. Co., 316 Eighth Ave., S., Minneapolis 15, Minn. According to the manufacturer, this radius brake eliminates the possibility of fracture or disintegration developing at the line of forming in working such materials.

All contact surfaces of the brake are adjustable in all planes and angles making it possible to obtain a true radius over the entire material width at the point of forming on any bend or type of material being worked, within the capacity of the unit. Adjustable stops are provided for holding to die tolerances the degree of angularity in all duplicated work. Adjustment bolts have lock screws. Contact surfaces, made of heat treated cold rolled steel, are removable for changes and replacements.

Tube and Conduit Clamp

No. 2868—Development of a new type clamp, adapt-

Only HENRY makes a Diaphragm Packless Valve that is NON-DIRECTIONAL

● Experience has taught the refrigeration industry that in a Henry Product it can always reasonably expect some extra value and a better feature of design and construction. The Henry Packless Valve is an outstanding example.

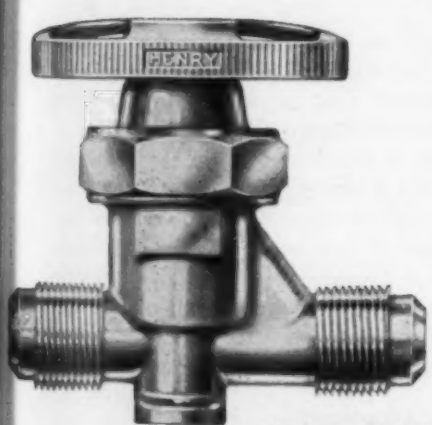
By means of a patented balancing channel in the lower valve stem, explained in detail below, the Henry Diaphragm Packless Valve cannot stick shut regardless of the pressure differential above or below the valve seat. When using a conventional valve, there is always the possibility that a valve installed in reversed position could fail to open if sufficiently high pressures should develop above the seat. The Henry Diaphragm Packless Valve, however, can be relied upon to give positive performance under all conditions of service because it is truly non-directional.

You will also like the Henry feature of having inlet and outlet ports in line on two way and three way valves. This eliminates tube bending and results in neater lines and lower installation costs.

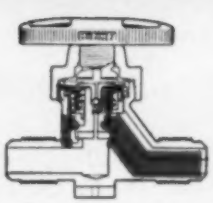
During the war Henry Diaphragm Packless Valves have been widely favored by all branches of the armed services. It is only natural that, as our country gradually turns to the problems of Peace, this Henry Product again will be the logical choice of manufacturers, jobbers, contractors and service organizations everywhere.

The Difference Between a Henry Non-Directional Balanced-Action Diaphragm Packless Valve and a Conventional Packless Valve

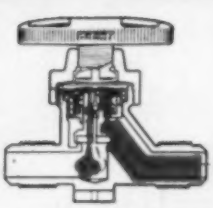
Available in a complete range of sizes with flare or solder connections.



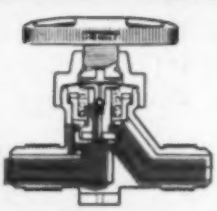
SOLD BY JOBBERS



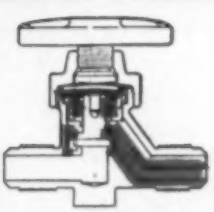
BALANCED-ACTION VALVE IN CLOSED POSITION—High pressure above the seat, low pressure below the seat. High pressure regions are shown in color. Pressure in spring cage below diaphragms is the same as that in main passage of valve body above the seat. This is due to seepage between the lower stem and the guide. Downward pressure of the bearing plate on the diaphragms seals the upper port of the balancing channel.



OPENING THE BALANCED-ACTION VALVE—As hand wheel is turned to open valve the diaphragms, because of pressure beneath them and their own snap action, rise and expose the upper port of the balancing channel. The high pressure, shown in color, unseats ball check and is instantly released through the open channel to the low pressure region below the valve seat, thus achieving "balanced-action" by equalizing pressures.



BALANCED-ACTION VALVE IN FULL OPEN POSITION—Equalization or balancing of pressures above and below the seat, as shown in color, guarantees that this valve can never "stick shut" but will always open positively, regardless of original differential in pressures. When there is high pressure below the seat and low pressure above, the balanced valve opens easier than other types because of the light weight spring.



CONVENTIONAL TYPE WITHOUT BALANCED-ACTION—As hand wheel is turned to open valve the diaphragms rise. When the differential between high pressure, shown in color, above seat and low pressure below seat is greater than force exerted by heavy spring, stem "sticks shut"—valve remaining closed. The heavy spring required in this type of valve greatly increases diaphragm wear and strain and causes stiff closing.

HENRY VALVE COMPANY

HENRY VALVE CO

3260 WEST GRAND AVENUE, CHICAGO 51, ILLINO

EXPORT DEPARTMENT, 13 E. 40TH ST., NEW YORK 16, N.Y. CABLE: ARL

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AMMONIA VALVES · FORGED STEEL VALVES AND FITTINGS FOR OIL, STEAM AND OTHER FLUIDS

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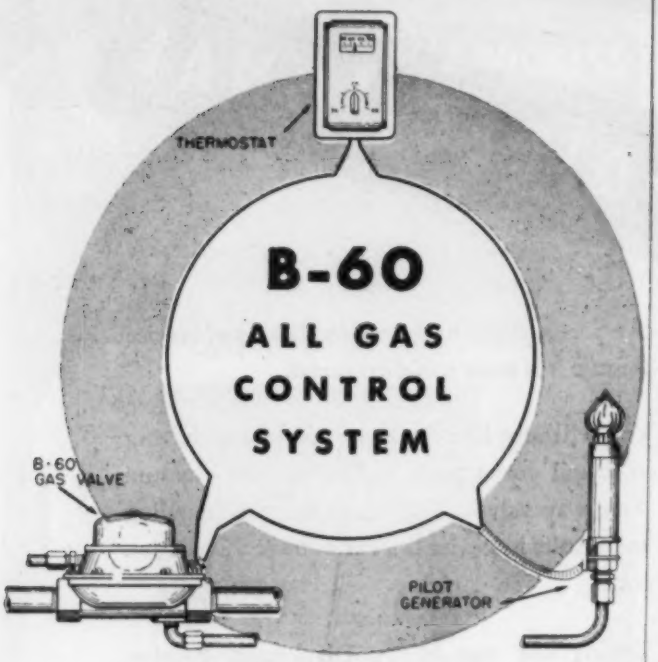

A completely self-contained and self-operating system, consisting of a T-80 Series Trimtherm Thermostat, a B-60 Gas Valve and a Pilot Generator. No outside current is needed.

PILOT GENERATOR—This ingenious device is an exclusive General Controls development. Designed on the thermocouple principle, the Pilot Generator supplies all necessary current for operation of the B-60 Gas Valve.

T-80 TRIMTHERM—Trimtherm's modern, streamlined appearance and advanced engineering design, make it a universal choice for accurate, remote control of room temperature.

B-60 GAS VALVE—Compact. Tamper-proof cover. Integral pilot valve assembly. Extremely strong valve body Increased seating pressure, maximum capacities. Locked binding posts prevent turning.

For further information, contact your nearest General Controls factory branch or distributor, or write for Catalog 52-B.

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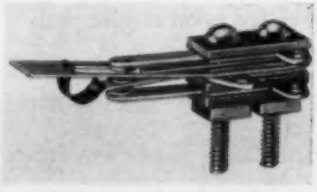
able for tube and conduit type installations of all kinds, has been announced by The Glenn L. Martin Co., Baltimore, Md. The clamp is shaped after an inverted lateral "s" and is fastened to the wall or frame with an ordinary screw. The tubing to be fastened is placed in the open side of the curve and the clamping ring passes around the back of the base, over the top of the tubing and down the front, where it is hooked under the curve at the front of the "s" to form a simple locking device.

The clamping ring can be made of a high grade synthetic rubber or other elastic material. The clamp proper can be moulded from a fabric base phenol fiber material or fabricated from formed sheet metal in any desired size. The combination results in a clamp which is extremely durable, yet light in weight and attractive. Now being used in plane installations for fastening hydraulic and pneumatic tubing, wire bundles and electrical conduits, the bodies are moulded in color to follow individual hydraulic or electrical runs.

When the clamps are used in a series any single tube or conduit can be removed without disturbing the others. The clamp also is readily adaptable for bonding. Use is in no way restricted to plane production and it could be readily used for other purposes such as fastening plumbing in housing. This can be done by merely substituting a fiber glass clamping ring to obtain the necessary durability for long periods of time.

Small Open Blade Switch

No. 2869—This small single pole open blade switch is designed for compactness and long life, according to the manufacturer, the Acro Electric Co., 1392 Superior Ave., Cleveland 14, Ohio. It is engineered with a beryllium rolling spring. Contact arrangements are for normally open, normally closed, or double throw circuits. The switch is actuated by the user, and standard operating pressure at the end of the blade is only 3 to 6 oz. It is rated at 15 amp, 115 volts, a-c.



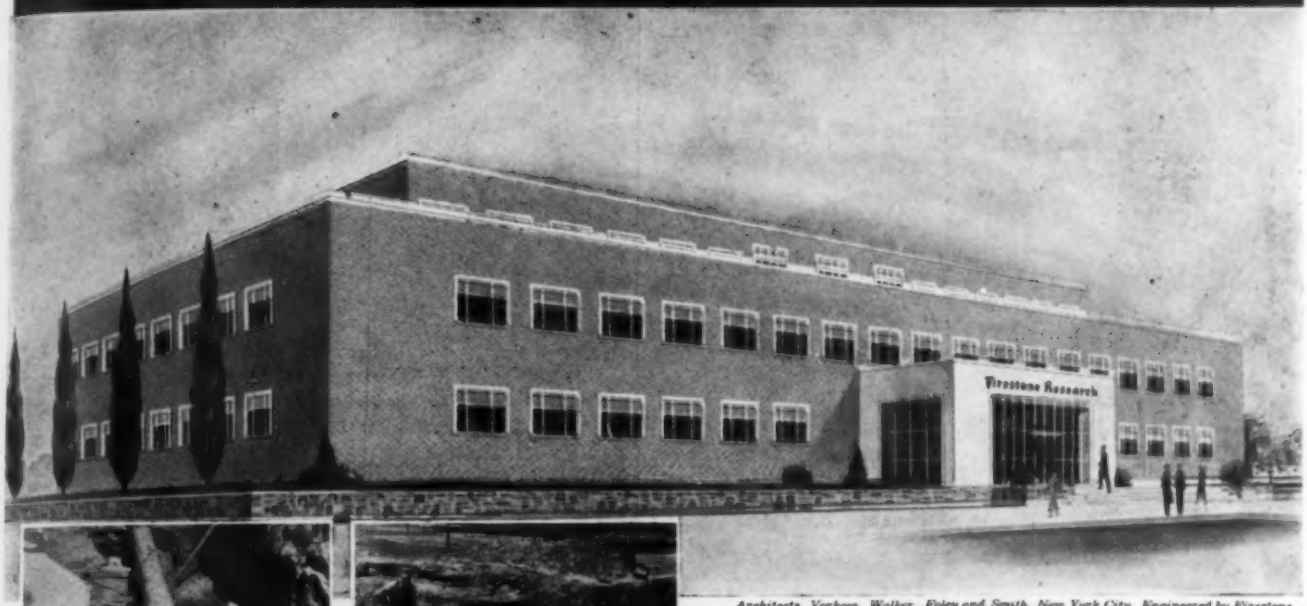
Fluids for Air Filters

No. 2870—Research at the laboratories of the Glycerine Producers' Association, 11 W. 42nd St., New York 18, N. Y., indicates that a glue-glycerine-water solution makes a good moistening material for filter bases such as are used in heating and air conditioning systems. A solution of 0.2 per cent glue in 50 per cent glycerine was found satisfactory. When the filter becomes dirty and clogged it can easily be washed clean with cold water and a fresh solution applied. Aside from the elimination of fire hazard, such treatment with the aqueous glycerine-glue mixture is said to effect substantial economies.

Analysis of Phosphate Content

No. 2871**—Low concentrations of the poly (glassy) phosphates are being employed in power plants and hot water systems to prevent feed line deposition and in air conditioning and refrigeration units to prevent deposition and corrosion. A method of analyzing these

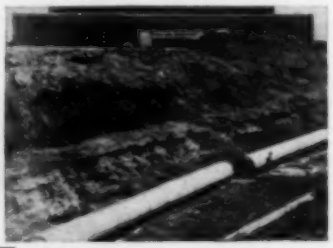
RIC-WIL STEAM CONDUIT CONNECTS NEW Firestone RESEARCH LABORATORY TO CENTRAL BOILER PLANT ONE MILE AWAY



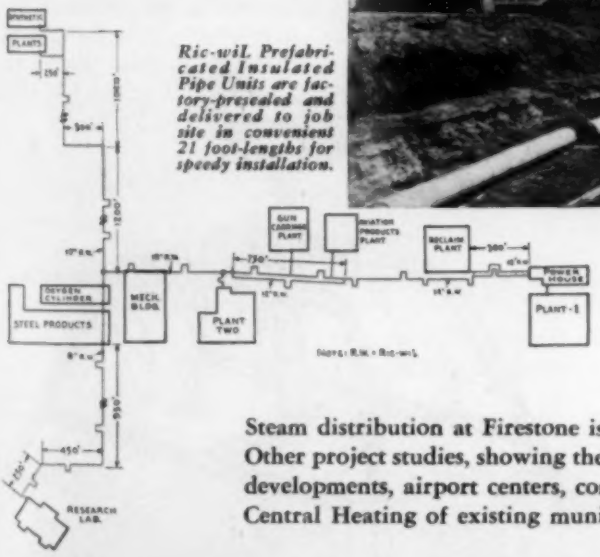
Architects, Verhaan, Walker, Foley and Smith, New York City. Engineered by Firestone.

Installing Ric-wiL Prefabricated Insulated Conduit on steam line to Firestone Laboratory. Note pipe and casing anchored at 45° offset.

Ric-wiL Prefabricated Expansion Loop "cold sprung" into position. Loops are fitted with drive couplers for easy assembly to straight runs.



Ric-wiL Prefabricated Insulated Pipe Units are factory-prepared and delivered to job site in convenient 21 foot-lengths for speedy installation.



The very latest developments in building design and services have been incorporated in the magnificent new Firestone Research laboratory. The objective was to provide the utmost in comfort for the chemists, physicists, engineers and technicians, and to supply those many services required in research work.

After an exhaustive study, it was determined that instead of a boiler plant at the site, it would be more practical to extend a steam line from the nearest factory building 2100 feet away, and thus obtain heat and power from the main power plant over a mile to the north. Steam is delivered to the laboratory in 8" Ric-wiL Prefabricated Insulated Pipe, at 180 P.S.I.

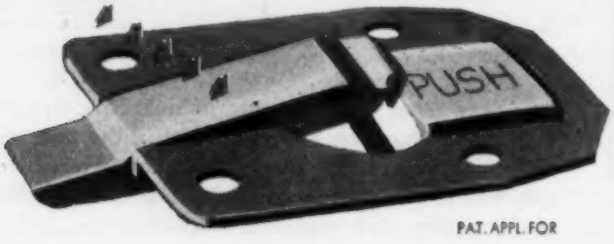
Every building in the vast Firestone Akron industrial community obtains its steam from one central plant. Schematic plot plan at left shows distribution lines—practically all of which are now in Ric-wiL Prefabricated Insulated Pipe Conduit.

Steam distribution at Firestone is described in detail in a booklet now in preparation. Other project studies, showing the application of Central Heating to community housing developments, airport centers, commercial groups, shopping centers and conversion to Central Heating of existing municipalities or neighborhoods, are available on request.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

CUT MAINTENANCE TIME WITH THE NEW HARTWELL FLUSH DOOR LATCH

PRESS and it's locked shut!



PAT. APPL. FOR

Designed for use on combat planes, the Hartwell *flush* latch speeds the opening and closing of access doors. It can be used on metal, plastic or wood, and on doors of varying sizes and thicknesses. It can also be used on cover plates, cabinet and locker doors and flush fixtures. The Hartwell *flush* latch is made of stainless steel, and can be supplied unmounted or spotwelded to an installation plate.

For detailed information about uses and adaptations of the new Hartwell *flush* latch, write: Engineering Department, Hartwell Engineering Company.

HARTWELL

ENGINEERING COMPANY

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Dallas, Texas • Kansas City, Kansas

concentrations is the "Poly Phosphate Comparator," recently announced by W. A. Taylor & Co., 7300 York Rd., Baltimore 4, Md. With this method a complete determination requires only 20 minutes, says the manufacturer.

After conversion, two reagents are added separately and the blue color formed is compared with the standards. This gives the total phosphate content. A determination on the cold sample (no boiling is necessary) gives the ortho present in the sample. The difference is the poly phosphate. The outfit consists of a comparison block containing eight standards, two comparison tubes, funnel, filter paper, graduate, flask, and reagents.

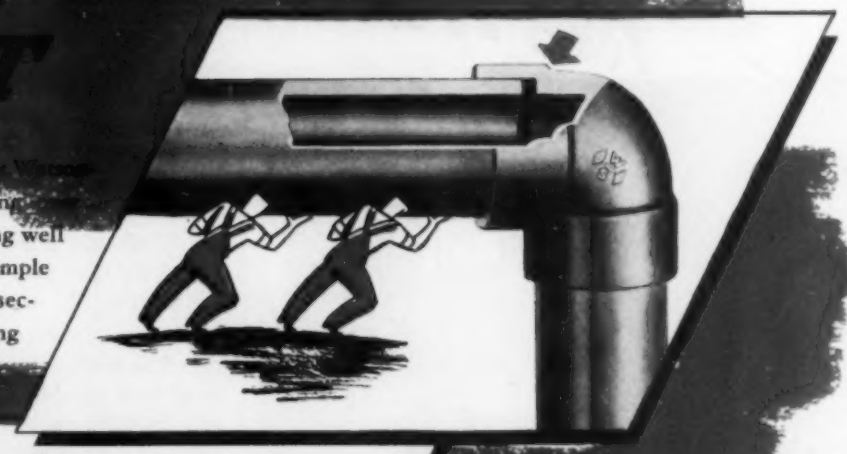
Portable Roller Conveyor

No. 2872**—For handling pipe, tubes, rods, and bars the John Moore Specialty Co., 6130 N. Hiawatha Ave., Chicago 30, Ill., has introduced the "Herculean" roller conveyor. It has an adjustable swivel center post which

raises the roller to a height overall of 51 in. Weight capacity is 1000 lb, and the unit will handle up to 12

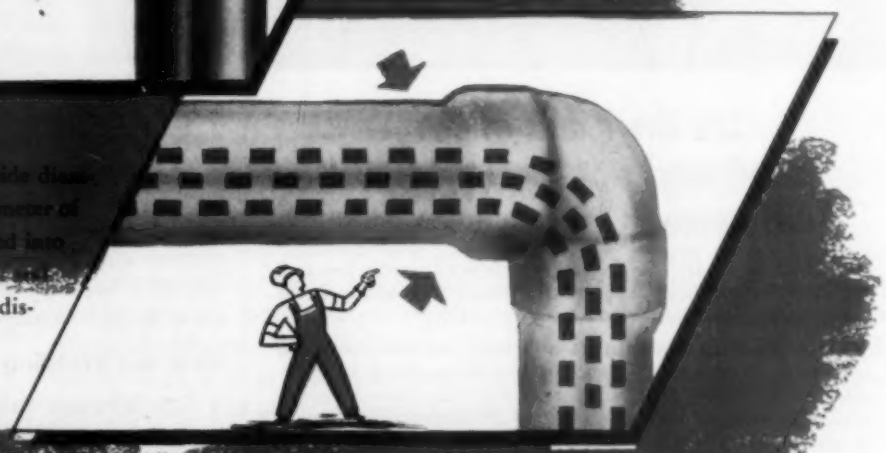
(*Continued on page* 160)

How to make permanently tight ...le ...k-proof joints ... FAST



● Slip a compact, ... Watson-Stillman Socket Welding Fitting ... end of pipe. Long bands, extending well beyond bottom of socket provide ample reinforcement, eliminating weak sections. Accurate measuring and cutting of pipe unnecessary.

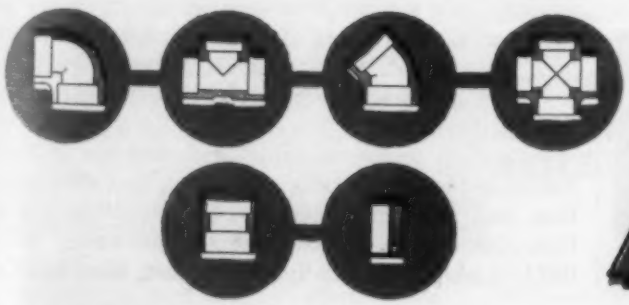
● ... clean ... pipe fillet weld. Deep socket, supports and aligns ... pipe, eliminating tack welding, and the use of special fixtures. Position of ... weld prevents welding icicles inside pipe ... clogged lines. Wall sections, 1¼ ... times ... minal pipe thickness permits proper heat penetration and correctly proportioned fillet weld.



● Smooth ... ...tered as inside diameter of fitting mate... inside diameter of pipe. The fitting and pipe are fused into one integral unit, permanently tight and leak-proof. Unaffected by vibration, distortion and shock.

Watson-Stillman Socket Welding Fittings are available for use with ... Schedule 40; Extra Heavy Pipe—Schedule 80; Schedule 160 Pipe and D... Extra Heavy, Forged Steel in ... through 4" I. P. S.

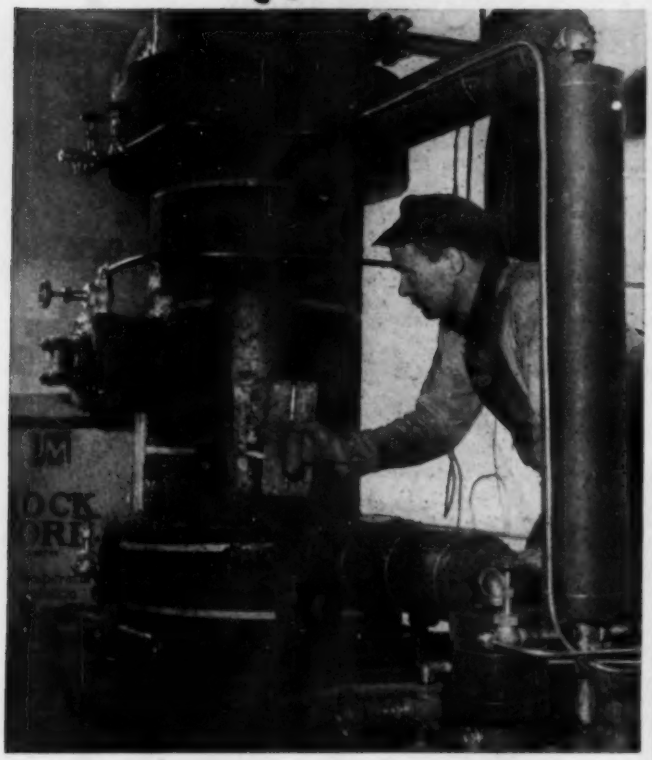
Sold Through Leading Distributors
WATSON-STILLMAN COMPANY, ROSELLE, N. J.



WATSON-STILLMAN

7354

Tricks of the trade



It's the *Knack* of the skilled mechanic that makes the difference in an insulation job.

THERE is an art to applying insulations properly—and only experienced applicators know the many little practices that make for success.

Johns-Manville places a trained force of workmen and engineers at your call—men capable of handling your insulation job from planning through application. In some areas, the organization is J-M's own construction force—in others, it's a J-M Technical Service Unit.

Because of its many advantages, J-M Rock Cork is preferred for low-temperature insulation by leading refrigeration engineers. Among the outstanding features of this basically mineral insulation are its low thermal conductivity, resistance to moisture and ease of installation.

For details about Rock Cork, write for brochure DS-555. Johns-Manville, 22 East 40th St., New York 16, N. Y.

And . . . remember an insulation's performance is only as good as its application.

JM JOHNS-MANVILLE ROCK CORK

(*Continued from page* 156)

in. pipe, says the manufacturer. The conveyor weighs 81 lb, and requires only a rectangle 28½ x 50 in. of floor space.

Prefabricated Assembly

No. 2873—"Lindsay Structure," prefabricated method of light metal assembly, is now available with panel sheets in ½ or ¼ in. expanded metal, according to a recent announcement by Lindsay & Lindsay, 222 W. Adams St., Chicago 6, Ill.

The same method of assembly is used with expanded metal panel sheets as with solid sheets, according to the manufacturer. With this method of assembly, a panel sheet with flanged edges is fitted over the flanges of channel framing. Tensioner channels are then applied over the edges of the sheet and are pulled down into the flanged frame by means of socket lock screws. This automatically draws the sheet into uniform tension between framing members.

This prefabricated assembly provides a simplified method of building guard rails of all types, catwalks, open partitions, window guards, ventilator screens, and similar applications. The expanded metal panel sheets can also be used in place of louvers or cut-outs in various types of cabinets and enclosures.

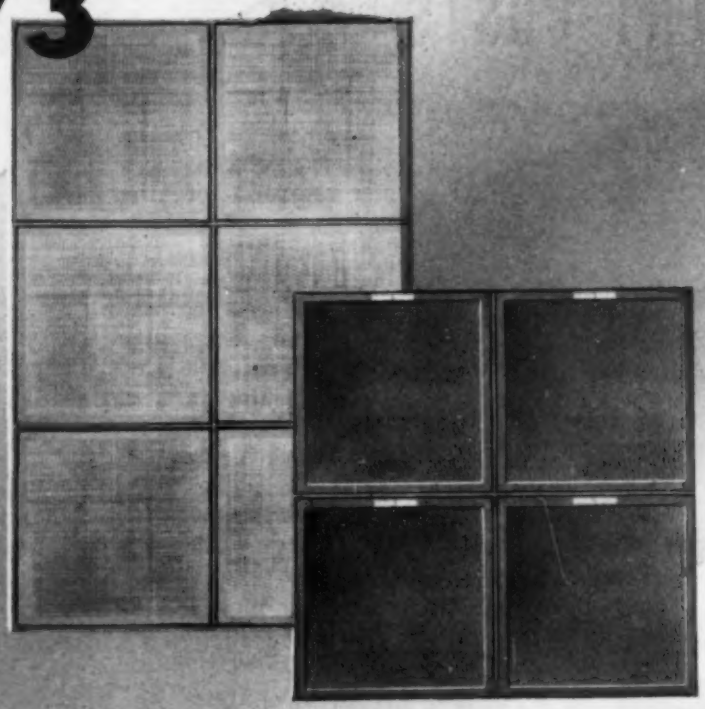
New Arc Welding Electrode

No. 2874—A new heavily covered arc welding electrode for welding low alloy, high tensile steels has been announced by the Electric Welding Div. of the General Electric Co., 1 River Rd., Schenectady 5, N. Y. Specially designed for use on carbon molybednum steel in the high pressure piping industry, it may also be applied to vessels (fittings) and structural weldments, says the manufacturer.

Known as type "W-56," the new electrode operates on either alternating current or direct current, reverse polarity, and its range of current is sufficiently broad to cover a wide range of plate thicknesses. It can be used in the flat, vertical, and overhead position and produces a relatively flat deposit, particularly in the vertical position.

According to the manufacturer, features of the new electrode include a stable spray-type arc, deep penetration, and excellent creep resisting qualities. In addition, the covering used produces an easily removed, light, friable slag, which sets up fast, thus facilitating

SAVE 1/3 THE FILTER AREA



WITH FAR-AIR FILTERS

50% GREATER C. F. M. CAPACITY, WITH LOWER S. P. DROP AND HIGH EFFICIENCY

Radically different construction permits Far-Air Filters to be operated with air velocities up to 700 F.P.M., with full retention of their characteristic over-all performance efficiency and low pressure drop. Our standard recommendation is 519 F.P.M., delivery 1200 C.F.M., through the 20 x 20 x 2 in. unit, compared to the ordinary and conventional 800 C.F.M. **For complete information write Dept. HPA.**

Progressive Loading

Herringbone construction presents more free area in line of air flow, keeping pressure drop down, and forcing progressive loading through wire mesh of uniform small size.

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MANUFACTURING ENGINEERS
LOS ANGELES CALIFORNIA
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SALES OFFICES: BUFFALO CHICAGO DETROIT HOUSTON LOS ANGELES MINNEAPOLIS NEW ORLEANS NEW YORK
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CUT AIR FILTER REPLACEMENT COSTS

with

RESEARCH AIR FILTER

For Filter Banks and Industrial Dust Collection

STOP MORE DUST with RESEARCH AIR FILTERS! High dust removal efficiency comes from patented construction. The air is reversed 21 times in its journey through the Research Air Filter—impinging on more than 30,000 tiny baffles per square foot. LOW RESISTANCE TO AIR FLOW—surface clogging reduced to a minimum.

Write For This Study

"The Effect of Dirty Air Filters on the Performance of a Winter Air Conditioning Unit"—shows how clean air filters cut heating costs, increases air volume circulation. Sent free on request.

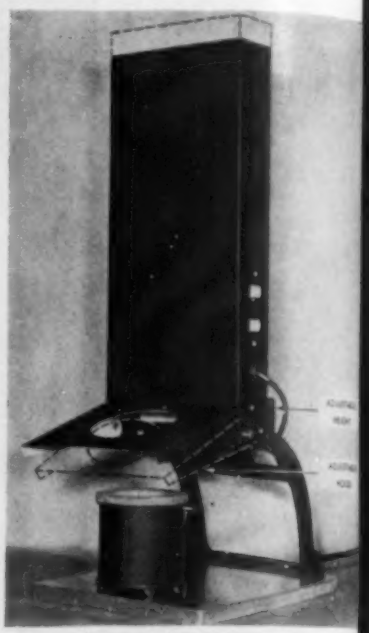
TECHNICAL DATA SHEETS on filters and filter banks are available. Write for copies.

RESEARCH PRODUCTS CORP., MADISON, WIS.

proper manipulation of the electrode. It is available in sizes 1/8, 5/32, and 3/16 in. in diameter, and meets the requirements of AWS classes E7010/E7011.

Adjustable Soldering Stand

No. 2875**—A fume stack which can be raised or lowered to accommodate any of the three heating elements used for soldering with iron, torch, or soldering pot is a feature of the new model soldering stand ("SS-112") recently announced by the Ess Specialty Corp., 96 W. Washington Ave., Bergenfield, N. J. A plate glass window (or magnifying glass) in the hood enables the operator to focus his attention on the soldered joint.



The stand is available with either a cast bracket for mounting on assembly tables or with a wood base. The fume stack is 3x9¼x32 in., and can be raised 2 in. The underside of the hood is finished in white to reflect all light possible.

Prelubricated Ball Bearing

No. 2876—A new feature in electric motor design, the prelubricated sealed ball bearing, has been developed by the Westinghouse Electric Corp., East Pittsburgh, Pa., to eliminate the necessity for greasing except at intervals of five years or longer, according to the manufacturer.

This new bearing consists of the standard single row of balls mounted in races of the same width as the double row ball bearings. Metal shields are anchored solidly in the outer race near the outer edges and extend down and inward to a close running clearance from the inner race. Adequate space for grease is thus provided and at the same time there are seals against the leakage of grease or the entrance of dirt.

This construction gives several operating advantages, says the manufacturer: the tightly sealed enclosure reduces oxidation of the grease, thus promoting longer grease life; maintenance expense is sharply reduced as frequent greasing is not required; grease is kept in and dirt is kept out; when motors are disassembled, the bearings, being enclosed in a cartridge, are protected against dirt. Furthermore, the hazard of overgreasing and the consequent grease seepage into windings is eliminated.

Transformer Welder

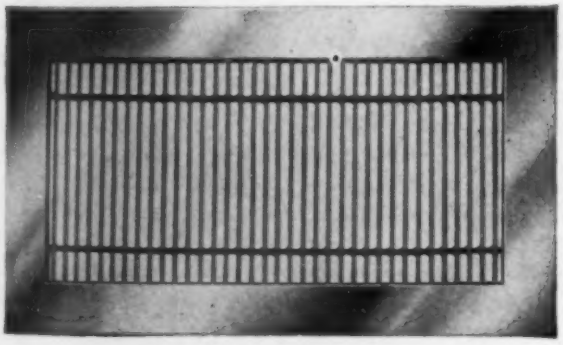
No. 2877—A new 200 ampere "Wilson Bumblebee" transformer welder has been announced by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

LOOK TO TUTTLE & BAILEY

THE scientifically engineered efficiency and built-in quality of Tuttle & Bailey Ceiling Diffusers, Grilles, Registers, Air Control Devices and Standardized Copper Convectors are well suited to the dream homes of tomorrow and the new type structures of the future.

Air Conditioning, Heating and Ventilating Outlet

AEROFUSE OUTLET

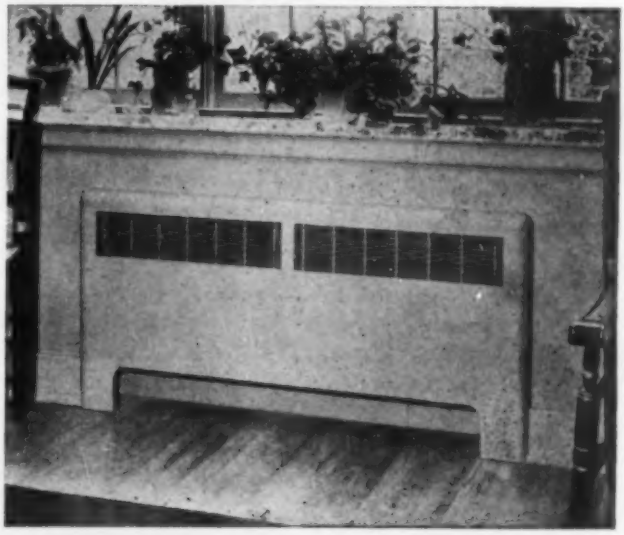


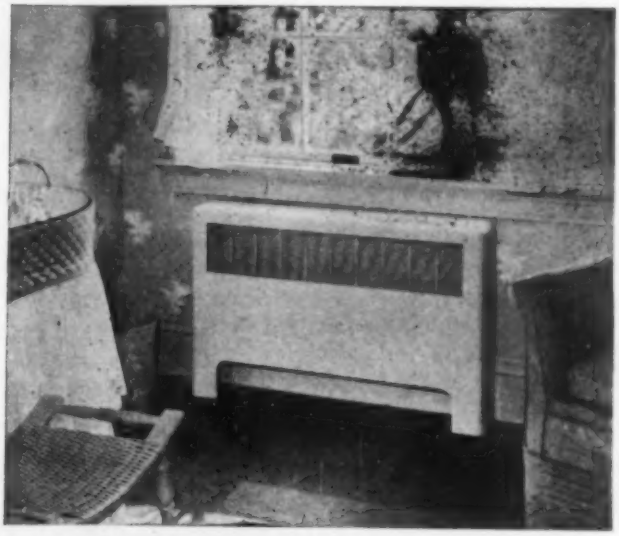
AIRLINE GRILLE

SINCE VE DAY . . .

cutbacks and cancellations of war contracts have made available a portion of our facilities for the production of items for civilian use.

Standardized COPPER CONVECTORS





Efficient Heating and Trouble-Free Service
The Beauty of Recessed Enclosures

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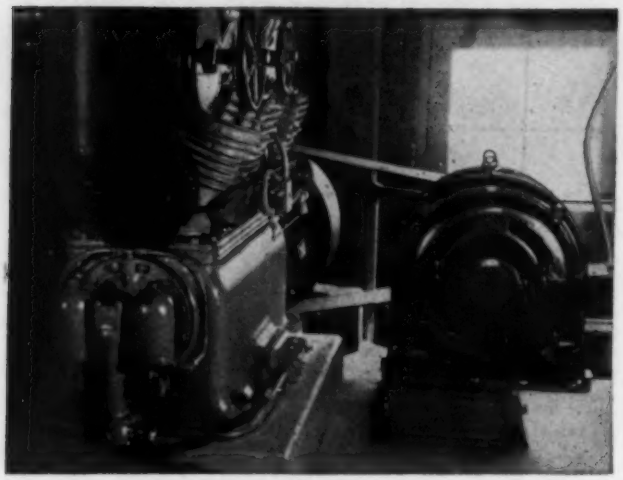
TUTTLE & BAILEY, INC.

NEW BRITAIN, CONNECTICUT

A Truly Satisfactory

SHORT CENTER BELT DRIVE

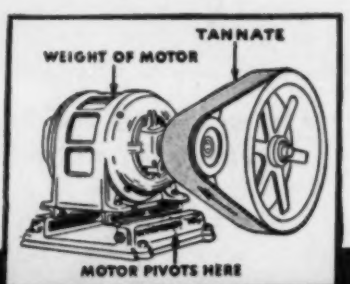


INSTALLED IN 1939 on 100 H.P. motor operating compressor for air conditioning system. It is still running . . . giving excellent service.

The TANNATE-ROCKWOOD short center flat leather belt drive is a distinct improvement in power transmission. The weight of the motor on the pivoted base *automatically* adjusts belt tension, so that there is always *maximum* transmission power, without strain.

The TANNATE belt is a second important factor. Its exceptional grip and flexibility make possible a drive design with a low belt tension. This not only saves wear on the belt and bearings but also provides a margin of extra capacity for peak loads.

Thousands of TANNATE-ROCKWOOD short center drives are now in use, and giving perfect satisfaction. This drive makes possible an efficiency and economy not to be had in drives with a fixed center. May we send you literature, without obligation?



RHOADS *Tannate-Rockwood* SHORT CENTER DRIVE

J. E. RHOADS & SONS

35 North Sixth Street, Philadelphia 6, Pa.

NEW YORK • CHICAGO • ATLANTA

According to the manufacturer, built-in capacitators make possible power economies, reduce power bills and power imput, and relieve overloaded transmission and plant feeder lines, making room for additional equipment.

The unit has two ranges of current, the low from 30 to 110 amp and the high from 90 to 275 amp. Continuous stepless current control is provided throughout each current range by turning the crank on the top of the machine. A full-view scale makes current settings easy to read at all times. The unit is also equipped with a disconnect switch. All windings are covered with the latest spun-glass fiber insulation.

Inner Corrugated Tube

No. 2878—"Seamlex" tubing with "type W" fitting, in welded or brazed types suitable for high temperatures and vibration, has recently been announced by the Seamlex Co., Inc., 27-27 Jackson Ave., Long Island City, N. Y. All parts are welded or brazed into a single unit. Weld-ends of the fittings project into the tubing, insuring correct axial alignment. The braid protecting sleeves are made of heavy gage seamless tubing and serve as reinforcements in the areas of stress. This inner corrugated tube, says the manufacturer, features deep convolutions and relatively heavy gage metal.

Arc Welding Machines

No. 2879—A new line of a-c arc welding machines, replacing its plug-in models, has recently been announced by the Ergolyte Mfg. Co., 3627 Lawrence St., N., Philadelphia 40, Pa. The new machines are built in all metal cases and the control panel is located on the front to provide easy view of the plug-in knobs.

Designated as "Standard 161" and "Standard 251," a feature claimed by the manufacturer for these machines is the ease with which the air cooling assembly and automatic arcing assembly can convert either machine to specific welding needs. By the addition of these units four different machines are made. The standard machine plus fan and conversion accessories provide a-c welding machines for continuous welding or ones that strike a quick arc with practically any type of rod, says the manufacturer.

Hydraulic Rams

No. 2880—Lightweight steel construction is used throughout the general design of "Hy-Speed" hydraulic rams, according to the manufacturer, the Reimuller Bros. Co., 9400 Belmont Ave., Franklin Park, Ill. A complete range of lightweight rams is available with 4200 psi as the basic pressure. Sizes are from ½ in. to 6 in. diameter. Used with standard foot power units or motor driven pumps and valves, the rams supply forces from 500 lb to 40 tons, says the manufacturer. When used with 1 cu in. per stroke ft power units, movements of from 0.1 to 4 in. result.

Self Lubricating Bearings

No. 2881—Bearings in compositions of carbon and

For Plumbing and Heating Conducting Systems...
AIR CONDITIONING AND REFRIGERATION
FOR NEW WORK OR REMODELING
There are many advantages in an installation of STREAMLINE Copper Pipe and Solder Fittings, both for you and your prospect.
The owner who buys a copper job actually buys long-life insurance for the comfort and livability of his investment. He procures a piping material that is highly resistant to rust and clogging—a system that will, under normal conditions, give him life-long, efficient service. Even in extremely abnormal water conditions, copper is generally the best in the long run.
The plumbing contractor who puts in a copper job, installs a material that is the most practical and handy to use—no back-breaking threading and lifting—less equipment to carry—less weight, and less space required.
A copper job is a "business-getter." Almost invariably it acts as a "silent salesman" in the procurement of additional jobs. It is a "reputation-builder," and there need be no "comebacks"—the job is right and it stays right.
STREAMLINE is advertised and marketed by this company for the use of experienced mechanics—the plumber and steamfitter. STREAMLINE Copper Pipe and Fittings can be procured only through legitimate plumber jobbers.
STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN
Best for Most Domestic and Industrial Piping Systems
STREAMLINE★
TRADE MARK REG. U. S. PAT. OFFICE
COPPER PIPE and Solder FITTINGS

graphite, or both, as well as bearings with various metallic contents for special applications are being produced by Morganite Brush Co., Inc., Long Island City 1, N. Y. Bearings of these materials have unusual properties, the manufacturer says, including self lubrication, and immunity to acids, alkali, and most solvents. In operation these bearings glaze cooperation surfaces with a protective coating. They are readily machinable, but may be molded with tolerances of 0.001 in. They may be plated, shrunk, press fitted, or vulcanized to rubber. They take molded-in fastenings and are supplied in any shape and with any contour required. Operating speeds to 5000 rpm with thrust loads to 30 psi at slower speeds are possible with these bearings.

Electric Positioning

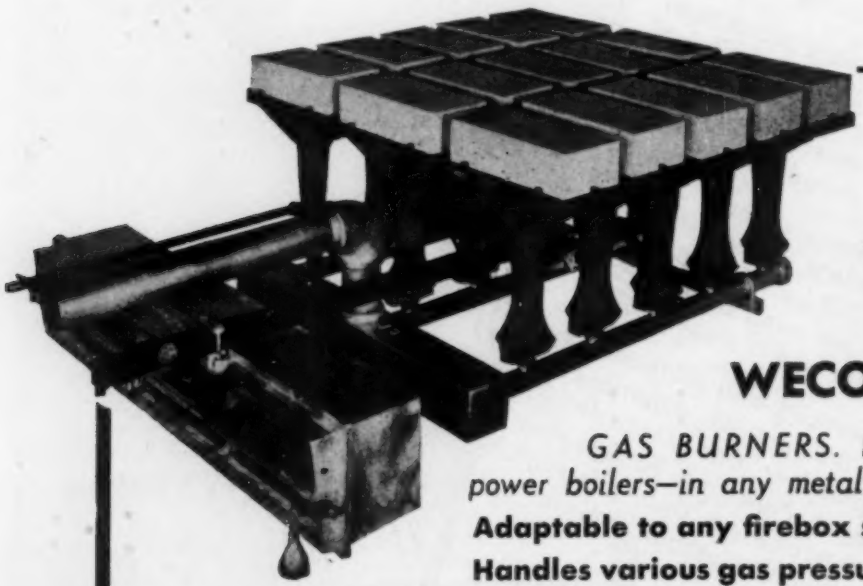
No. 2882**—New electric positioning controls have been developed under the "Yardeny" system by the American Type Founders, Inc., 11 W. 42nd St., New York 18, N. Y. These instruments have been used by the Navy, and according to the manufacturer, their construction indicates many desirable applications in industry.

There are four basic types of controls: The continuously variable control is a non-synchronous follow-up control provided with a repeat back indicator for positioning the shaft of a reversible motor to any point of revolution. The multi-turn selector is a motor driven device whereby its connected load may be placed in any one of six adjustable positions over one or a number of revolutions. The dual control incorporates the features of the first two. By this combination the operator may position the load to any one of the present positions or, by turning a knob, to any point over the full range. The fourth type is an integrating selector that provides automatic setting of the load to a large number of positions by means of a comparatively small number of pushbuttons.

Armor Clad Electrode Holder

No. 2883—A new armorclad (screw type), fully insulated electrode holder has been announced by the Electric Welding Div. of the General Electric Co., 1 River Rd., Schenectady 5, N. Y. Designed from the operator's viewpoint, the new holder is recommended by the manufacturer for use wherever durability, maximum safety, and minimum operator fatigue are desired.

A feature of the new holder is its head, which is completely enclosed in a sheath of aluminum armor. This armor protects the insulation, resists weld spatter, and helps eliminate the possibility of accidental contact with the welding circuit.



50,000 to 10,000,000 B.t.u. with WECO-N.G.E. Series F600

GAS BURNERS. For use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Adaptable to any firebox shape or size.

Handles various gas pressures and effects low draft loss.

The Series F600 Burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Full automatic controls—that operate properly—can be easily applied. *Write for F600 Bulletin.*

THE WEBSTER ENGINEERING CO.

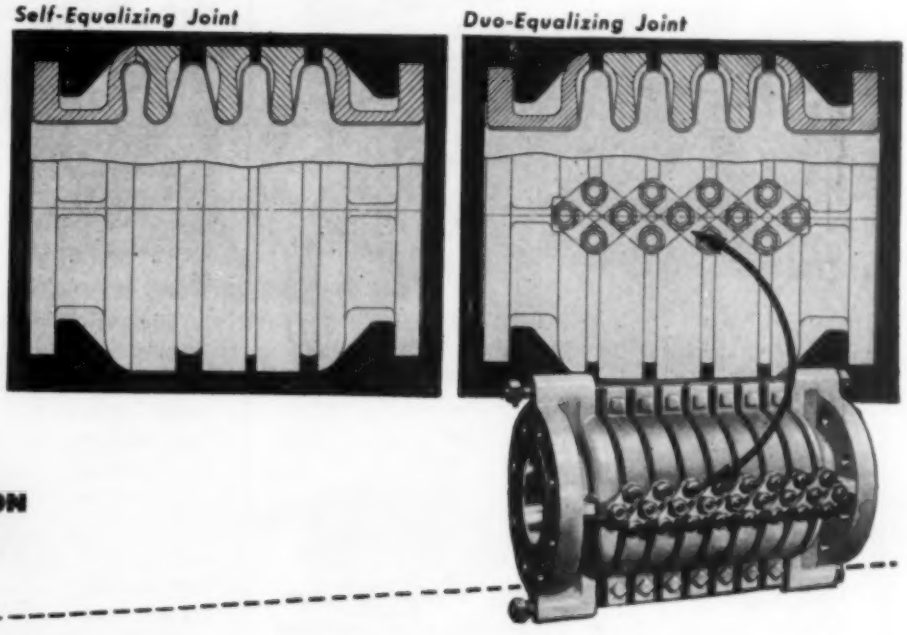
TULSA —DIVISION OF— OKLAHOMA

Surface Combustion . . . . . Toledo, Ohio

Here's Why Zallea improved duo-equalizing* expansion joints endure in service!

• These diagrams show what happens to two types of corrugated expansion joints in a contracting or expanding pipe line. Both joints have moved the same amount, but note the *individual* movement of the several corrugations. In the ordinary self-equalizing joint, one corrugation is completely closed, the next has not moved at all and the other two have moved only partially; but in the duo-equalizing joint each corrugation has absorbed the same amount of movement.

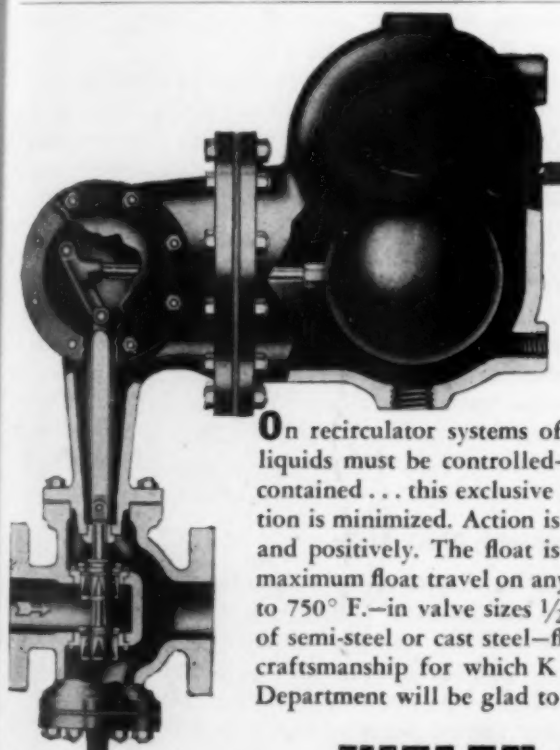
In the new Zallea Improved Duo-Equalizing Packless Expansion Joint, pantograph chain linkage guarantees equality of corrugation movement. These chains link all corrugations together so that each one must move equally and simultaneously with all others, during either expansion or contraction of the line. That's why they endure in the severest service.



Made of copper, stainless steels, and other corrosion resistant alloys . . . traverse up to 7½" . . . for pressures from vacuum to 300 psi . . . for temperatures from sub-zero to 1600° F. For complete description and specifications write for Bulletin 45.

"Code-Craft"...
ZALLEA BROTHERS & JOHNSON
EQUIPMENT FOR THE PROCESS INDUSTRIES
816 LOCUST ST. • WILMINGTON 99, DEL.

*U.S. Pat. Pending



NO "GLAND TROUBLE"

because UNITROL Level Controller has no packing glands or stuffing box

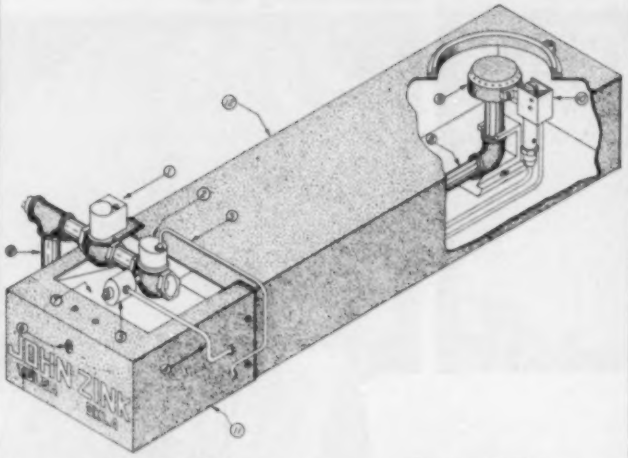
On recirculator systems of condenser hotwells, deaerators—or wherever the level of liquids must be controlled—UNITROL will do it more accurately! Simple . . . self-contained . . . this exclusive design eliminates trouble-making restrictive elements. Friction is minimized. Action is free and unhampered. Feed or drain is regulated promptly and positively. The float is linked to the inner valve through ratio connection, with maximum float travel on any size valve of only 7 inches. Available for temperatures up to 750° F.—in valve sizes ½" to 4"—integral casting construction—valve and floatcage of semi-steel or cast steel—float of seamless copper or stainless steel—and with the fine craftsmanship for which K & M has been recognized for 75 years. Our Engineering Department will be glad to make specific recommendations.

Write for Catalog 66-C

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
2015 43rd St., North Bergen, N. J.

Awarded our employees for outstanding production achievement

JOHN ZINK'S
Conversion Burner Package Unit Complete with Controls



Series P-300
burns 175 cu. ft.
of gas per hr.

Series P-600
burns 400 cu. ft.
of gas per hr.

This light weight Luminous Flame gas conversion burner gives automatic heat for the *lowest equipment cost* of any appliance on the market. Applicable to 98% of all domestic furnaces, for new or conversion installations.

This John Zink Conversion Burner was developed for use on artificial and mixed gases as well as natural.

The burner can be furnished with any type of standard electric controls.

Pilot light assembly is adjusted and located in a position to insure lighting of the main burner even though the normal gas pressure is decreased. The complete piping, burner head and pilot assembly may be removed for inspection and cleaning in a few minutes' time. These working parts are removed and reinstalled without disturbing that portion of the air box which is bricked in the ash door.

Write for descriptive literature

•

John Zink Company

4401 South Peoria

TULSA, OKLAHOMA

New York - Los Angeles - Detroit - San Francisco - Houston

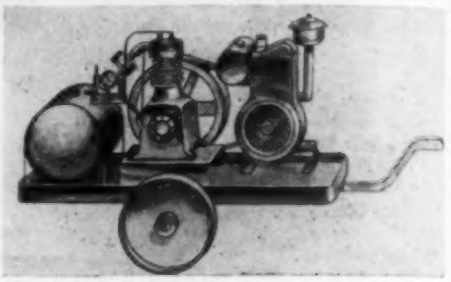
Designed to accommodate electrodes up to and including ¼ in. in diameter, the holder is easy to use, light in weight (15 oz), and unusually cool in operation, according to the manufacturer. The threads of the push-up rod do not carry current. A soldered cable connection also helps the holder to remain cool. The width of the electrode slot limits the size of the electrode which can be inserted, thus preventing overloading.

Name Change for Heater Manufacturer

No. 2884—The Electric Air Heater Co., Division of American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind., has recently announced that the company has changed its name to the Electromode Corp., at the same address. Among the products manufactured by the company is an electric unit heater.

Material Pump

No. 2885*—The "Versatal" material pump, designed to dispense and apply a wide variety of materials, including paints, lacquer, mastic, sealers, insulating materials, caulking compounds, has recently been announced by the Alemite Div. of Stewart-Warner Corp., 1826-1852 Diversey Parkway, Chicago 14, Ill.



The pumps operate on air power, and from one to six operators may work simultaneously using as many different spray heads and material lines from a single pump. Both light and heavy consistency materials can be handled by these pumps under conditions of extreme heat or cold, says the manufacturer. Another feature of this new development is an automatic agitator that is designed to maintain an even material mixture.

Model "7804C" is a stationary barrel pump, designed to fit over the top of any standard 54 gal barrel, and is recommended by the manufacturer for handling heavy or viscous materials. Model "7805C", also a stationary barrel type, is designed to handle fluid type materials. There are also portable models with an attached 12 gal material container.

Testing with Black Light

No. 2886—Light which no one has seen is aiding the workers at Surface Combustion Corp., Toledo, Ohio, to make a highly visible production increase in aircraft heaters. The invisible production factor at the plant is black light. The ultraviolet rays of black light are so fast they cannot be seen, but they have the power to excite the stored light in fluorescent material so that it will emit light which the material is powerless to produce alone. Factory records were produced to show how this "black magic" has made a tremendous contribution to larger delivery schedules.

It is important that combustion air and warmed air for heating the plane do not mix. That is why pains

IS IT LATER THAN YOU THINK?

Oiljak, like other American manufacturers, continues to devote all its facilities to the production of war material, to speed the approaching day of victory.

Yet, at the same time, we consider it no less our duty to plan for the future, to do our part in easing the change-over to a healthy industrial economy during the competitive peacetime years that lie ahead of American industry.

Oiljak offers you complete manufacturing facilities with up-to-date machines operated by men whose production record on war contracts compares favorably with normal peacetime costs; a record achieved by a minimum of rejections, a steady streamlined flow of work and materials through the plant, and a special assembly-line technique for which Oiljak is famous.

So before you set up the manufacturing procedure for *your* peacetime products, it may well be worth your while to get acquainted with all the facilities which Oiljak can offer you.

ARMY-NAVY "E"

MACHINING • STAMPING WELDING
PLATING • FINISHING ASSEMBLING

METAL MANUFACTURERS

The OILJAK Mfg. Co. Inc.

MONTCLAIR, NEW JERSEY

THE JOB COMPLETE FROM BLUEPRINT TO FINISHED PRODUCT

WILLIAMS

SUPERIOR DROP-FORGED TOOLS

"VULCAN SUPERIOR" CHAIN PIPE TONGS

7 sizes, with either Flat Link or Cable Chain, for pipe and fittings 1/8 to 12".

● Pipe or fittings—it makes no difference to "Vulcan Superior," the universal service tong. You can switch from one to another without adjustment or change of parts. And "Vulcan Superior" is the only chain tong with *reversible* pipe-and-fittings jaws. When one set of teeth begins to wear, simply remove the Through-Bolt and reverse the jaws. Sold by Plumbing Supply and Industrial Distributors everywhere. Literature on request.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y.

★

DISTRIBUTORS WANTED

One of our clients, a prominent air diffusion equipment manufacturer, now has several territories available for representation that offer exceptional opportunities to establish a permanent and profitable business . . .

Write today for full details — all correspondence will be held in strict confidence.

★

WESTON-BARNETT, INC.

Advertising

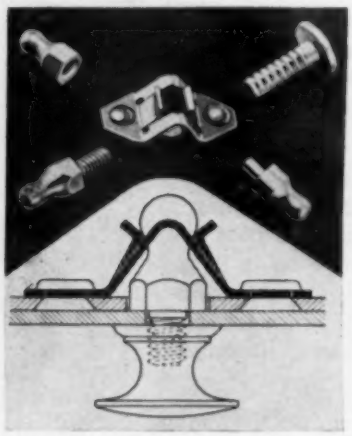
520 NORTH MICHIGAN AVE.

CHICAGO 11, ILLINOIS

must be taken to detect possible leaks in the seams of the metal cylinders. Little is known about fluorescence, but the manufacturer is satisfied with knowledge of what it can accomplish in testing aircraft heaters. A few drops of the fluorescent fluid are placed on the inside of welded seams of the cylindrical metal sections used in each heater and within 15 minutes the fluid has penetrated the most minute hole should there be one. The outside of the heater is then exposed to black light in a dark testing booth. If things look black to the girl testers, that's good. If there is a glow, there is a hole.

Spring Steel Latch

No. 2887—The new spring steel "Speed Nut" latch (No. 1663) has been developed for quick attachment and removal of box covers, access doors, panels and inspection plates, says the manufacturer, Tinnerman Products, Inc., 2018 Fulton Rd., Cleveland 18, Ohio. The spring arms snap over ball or grooved studs to provide firm attachment, yet studs may be quickly withdrawn. This latch is available in five material thicknesses to provide the desired degree of pull-out tension. Three styles of ball studs are available: drilled and tapped for 6-32 screws, threaded shank (6-32 thread), and plain shank for riveting. These, as well as the grooved stud, are provided in various lengths to suit application requirements.



Gas Gage for Aircraft

No. 2888—An electronic instrument weighing less than 16 lb, which is said to increase the bomb carrying capacity of heavy bombers by as much as thousands of pounds, was recently demonstrated by the Minneapolis-Honeywell Regulator Co., which designed and is making the new device. Called the "Liquid Level Indicator," the instrument is a gas gage so accurate in operation as to obviate the need for carrying extra fuel, says the manufacturer.

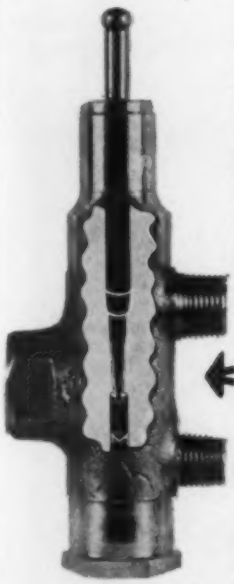
Developed at the request of the Air Technical Service Command, the new device is accurate within five per cent under extreme conditions of temperature, altitude and plane attitude, it is said. With no moving parts, bellows, gears, cams, or levers to get out of calibration, the gage weighs slightly more than present fuel measuring systems and operates from an infinitesimal electric current which is passed through the gasoline tanks.

Heavy bombers such as the B-29 carry a large quantity of extra gasoline as reserve capacity and this gasoline adds greatly to the plane's weight. Technicians and army officers who have tested and flown with the new instrument have said the new gage will make it possible to eliminate all or most of this extra gallonage, according to the manufacturer. The principle of the

Halt NEEDLESS WASTE OF Power!

Such a small operating part as a stem . . . its design and structure, its finish, can mean the difference between costly power loss and real *saving* of fuel, steam, power . . . controlling dampers and valves.

LOCKE REGULATOR STEM **STOPS . .**



— innumerable times in its movement up or down within the pilot valve, according to the pressure motivating it—because of its exclusive design which permits a halt at any point in its travel. Precision hand-tooled, this stem adds to Locke Regulators' extreme sensitivity in controlling dampers and valves.

Increase or decrease of pressure operating the Locke Regulator produces corresponding response in the thrust of the Locke stem which ordinary machined units cannot deliver. A new catalog describing Locke Regulators should be in your reference and purchase files.

A catalog will be forwarded upon your request.

DIVISION OF THE H. T. WILSON MACHINE CO., INC.

LOCKE REGULATOR COMPANY

WALTER AND OSBORNE STREETS

SALEM, MASSACHUSETTS

MODEL REGULATORS · DAMPER REGULATORS · FAN ENGINE REGULATORS · BACK PRESSURE VALVES · BALANCED VALVES · ELECTRIC VALVES · REDUCING CONTROLS FLOAT CONTROLS · PILOT CONTROLS · PUMP GOVERNORS · VACUUM BREAKERS ENGINE STOPS · MASTER REGULATORS · OIL CONTROL VALVES · SOLENOID CONTROLS

Ready IN 10 SECONDS to thread 1" to 2" pipe

Self-contained, semi-automatic RIGID No. 65R

No. 65R stands up handily on its own feet when not in use.

• You save time and bother when you use the RIGID No. 65R. It gives you perfect threads on 1" to 2" pipe, with one set of high-speed steel chasers that adjust to size in 10 seconds—no fooling around with 4 sets of dies. Workholder sets to pipe size instantly—no bushings. A fool-proof easy-working threader of rugged steel-and-malleable construction. Order from your Supply House . . . we're doing our best to keep it stocked . . . keep trying.

RIGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

Every Office Needs A Salvage Chief

appoint yours today!

Uselessly stored in many American offices today are tons of *war material!* Vitally needed paper—the raw stuff of blood plasma boxes, shell cases, supply parachutes—*V paper!* It takes many forms . . . dead files, old correspondence, records.

It's easy to put off getting that paper together, bundling it and turning it in. But you should do it for the war effort and for your own sake. Only in this way can we help avoid further civilian paper allotment cuts.

That's why every office should appoint *one person* to act as Salvage Chief. He—or she—can organize the effort, and arrange for regular Paper Salvage days. And the Salvage Chief can remind everyone to adopt conservation measures—to use less paper—as little as possible.

Many organizations which sell their waste paper turn part of the funds over to buy little extras for wounded veterans, or to support some other worthy community project. Thus you have a chance to make your paper serve *twice.*

Get your office paper salvage program rolling *now!*

This advertisement prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information. Space contributed to Double V Waste Paper Program by this publication.

new device makes it applicable to a number of other uses where the accurate measurement of liquid is essential, it is believed.

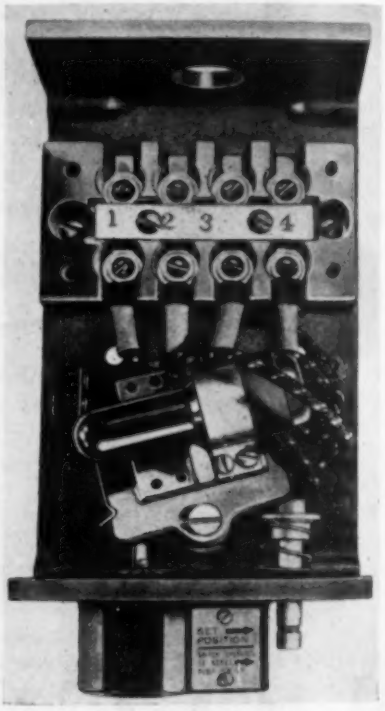
Welding Electrode Carrier

No. 2889—A case designed to prevent scrapping of welding electrodes due to cracked and chipped flux coating and to carry a supply of electrodes suspended from the welder's belt has been announced by the Atlas Welding Accessories Co., 14824 Wyoming Ave., Detroit 21, Mich.

Long life of the case is assured by riveted harness leather construction, the manufacturer says. A broad loop is provided for attaching to the welder's belt. Height of the case is 12 in. and the diameter is 3½ in. It has a capacity of 8 to 10 electrodes.

Pressure Switch

No. 2890—The pressure switch shown, manufactured by Walter Kidde & Co., Inc., 140 Cedar St., New York 6, N. Y., is an accessory device designed for use with built-in carbon dioxide fire extinguishing systems. It assists in isolating the fire by automatically cutting off electrical circuits in fans, blowers, or other electrical equipment when the extinguishing system operates, says the manufacturer. It is a self contained, mercury contact-type switch suitable for applications which employ gas or air pressure.



The pressure switch is connected by a bleed pipe from the main distribution line and is operated by the carbon dioxide in passing through this distributing piping to the discharge nozzles. The gas pressure actuates a plunger which trips the breaker arm of the switch, opening or closing the circuits desired. The device is available for control of two, three, or four circuits, each of which may be wired for normally open or normally closed operation. The switch is provided with a manual reset to restore circuits to their original position after operation due to fire.

Plan Now FOR NEXT SEASON'S HEATING REQUIREMENTS

Now is the time to be planning your heating needs for next season. There is an Airtherm Unit Heater to properly, efficiently heat any plant with a saving in fuel.

AIRTHERM PROPELLER TYPE STEAM UNIT HEATERS

Airtherm Steam Unit Heaters are individually controlled. They provide heat only where you want it, and when you want it. They are available in both vertical delivery and horizontal delivery types for ceiling or wall mount.

AIRTHERM BLOWER TYPE STEAM UNIT HEATERS

A high velocity unit which assures uniform temperature distribution and maximum heat flow effecting savings in both fuel and maintenance cost. This Airtherm Unit is suited to duct installation. Capacities range from 216,000 to 825,000 b.t.u.

Send us your specifications now. Our engineering department is at your service.

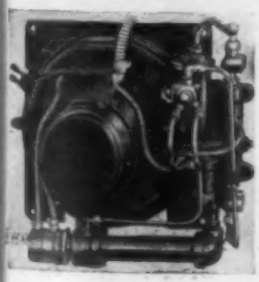
AIRTHERM
MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

"I've known Johnson Burners since I was a kid... that's why I decided to sell them"

"Ever since 1921 when I started work in the fuel oil business, I've been seeing Johnson Burners in operation. While I was on the delivery truck I saw how easy they are on oil consumption. I've serviced dozens of them in the homes of customers and I know how they're built. I've come to the conclusion Johnson Burners are the kind that users swear *by* . . . not *at*.

"When my partner and I decided to add heating equipment to our fuel oil business, our first thought was to get the Johnson Burner dealership. If we can have the Johnson line, I know we'll be selling burners that will make money and friends for us.

"May we have an early answer . . .we want to get all set for the building boom that is about to hit our town."



There's a Johnson Burner for every heating need.

Letters like this are no novelty to us. In the past 42 years, we've established many Johnson dealerships. It's no accident that 75% of them are still active and going strong . . . still mutually profitable and mutually cordial.

Maybe you ought to be selling Johnson Burners. We will gladly tell you if there's a franchise open in your territory.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
401 No. Broad St., Philadelphia 8, Pa.

...An organization whose products well serve the industry

● For more than a quarter century Acme products have served the industry faithfully and well. Back of the products is an organization carefully built up through the years to engineer and fabricate equipment that has an established reputation for efficient and dependable operation in the field ..and a service to customers that is practical, helpful, reliable.

No product can be better than the workmanship that goes into it. At the Acme plant is employed an outstandingly competent group of factory workers long experienced in the building of refrigeration and air conditioning products. Many have been on the job 10, 15 and up to 25 years.

The engineering department is probably larger than one might expect ...for engineering and designing form the foundation upon which the reputation for performance of Acme products is built. This engineering service is available to all Acme customers in helping solve difficult problems.

Service in field has always played an important part in Acme's overall operation. Through close personal contact with customers on a nation-wide basis it is possible to be in constant touch with the operation of equipment in all types of installations. The accumulated experience gained from the field is at your service without obligation. Acme representatives are located in principal cities. Maybe an Acme man can help you. See your phone book for his address, or write.

ACME PRODUCTS — Evaporative Condensers • Forced Convection Units • Ammonia Condensers • Pipe Coils • Freon Condensers • Dry-Ex Water Coolers • Oil Separators • Liquid Receivers • Flooded Water Coolers • Hi-Peak Water Coolers • Heat Exchangers

Write for Catalog on any item.

ACME PRODUCTS

ACME INDUSTRIES
JACKSON • MICHIGAN

Portable Lightweight Heater

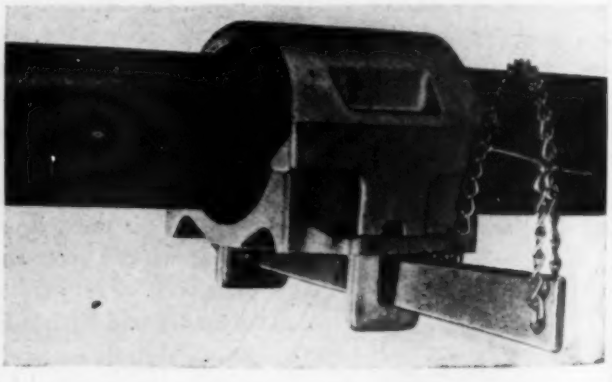
No. 2891—Designed for the comfort of men carried in hospital airships, Surface Combustion, 2375 Dorr St., Toledo 1, Ohio, has announced a new portable "Janitrol" aircraft heater which also is applicable to heating helicopters, preheating plane engines and other uses in and out of the field of aviation.

The portable feature is entirely new to aircraft heating, according to the manufacturer. The need for a unit which could be easily installed and removed arose when cargo ships whose original design did not include heat for cargo space were used for hospital ships. The new heater is self contained except for motive power, weighs less than 38 lb and has a heat output of 40,000 Btu per hr. In performance, says the manufacturer, the unit more closely approaches a 125,000 Btu heater because it takes air for operation from the cabin rather than having to raise the temperature of colder outside ram air. The fact that no outside air is needed to operate the heater is what makes it especially suitable for helicopters. No motion of the ship is necessary for the heater's operation from ground level to its 15,000 ft ceiling.

To put the heater into operation simply requires plugging to an electric connection and flicking the on and off switch. High, medium, and low operation is obtained with a fuel control switch. The automatic control system can be operated by a room thermostat if desired. A 3⅓ gal fuel tank, sufficient for eight hours' continuous operation, is built into the unit. It also has its own fuel pump driven by a small motor and a circulating air fan driven by a ½ hp, 24 volt motor.

Flexible Pipe Couplings

No. 2892**—Faster coupling of pipe with greater flexibility is claimed by the manufacturer, Drinkwater, Inc., 2323 S. Michigan Ave., Chicago, Ill., for a new line of



"Presto-Lock" flexible pipe couplings. They are made in 11 sizes from 1¼ to 16 in.

A feature of the couplings is that they can be used with any plain end pipe without threads, grooves, or flanges. No wrenches or special tools of any kind are required in assembly. Only a hammer is needed to tighten wedge keys after the two sections are fitted over pipe ends and wedge keys have been inserted in the key channels. The procedure, according to the

manufacturer, is so simple that even the most inexperienced workmen can assemble the couplings in a matter of seconds.

There are three parts: Two malleable iron castings and a wedge key. Sizes 1¼, 1½, 2, 2½ and 3 in. are equipped with one wedge key and chain assembly to prevent loss of parts. Sizes 3 to 16 in. have two wedge keys but no chain assembly. The gaskets have been specially designed to effect a permanently tight seal on all types of pipe lines. Three types of gaskets are available—synthetic rubber, "neoprene," and natural rubber.

With these couplings any plugged or frozen lines can be released immediately by a tap of the wedge key, says the manufacturer. Pipe can be readily turned if necessary and any section can be removed without affecting the remainder of the line. All coupling parts are salvageable upon relocation of pipe lines and gaskets can be readily replaced when they are worn out, it is said.

All Position Welding Electrode

No. 2893—A shielded arc electrode for general purpose welding of mild steel has been announced by the Lincoln Electric Co., 12818 Coit Rd., Cleveland 1, Ohio.

Designated as "Fleetweld 47," it offers such advantages as low spatter loss, easy slag removal, and excellent re-striking characteristics, according to the manufacturer. It conforms to American Welding Society electrode specifications Class E-6012 and E-6013 and

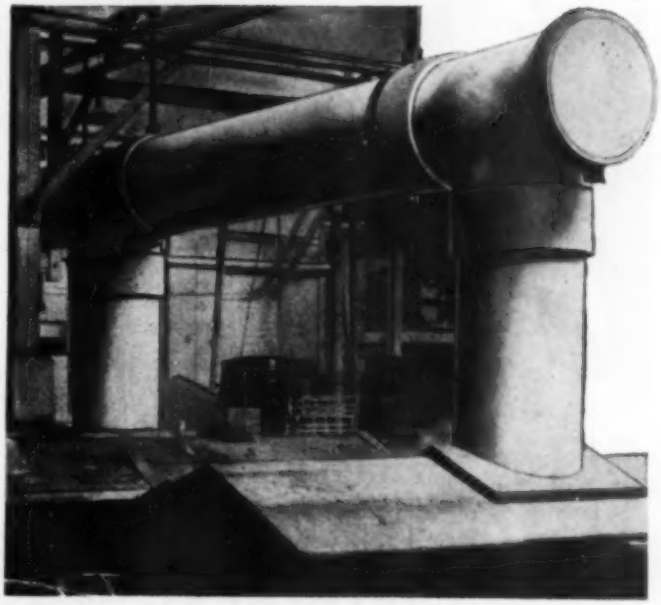
We have built, are building, and shall continue to build all types of custom-made coils for air conditioning and refrigeration equipment.

It will cost you nothing to ask us for a quotation on your requirements.

SWAN ENGINEERING CO., INC.

746 Frelinghuysen Avenue
Newark, N. J.

FIGHTS CORROSION!



Transite asbestos-cement ducts resist corrosive attack by many vapors, fumes, gases

WHERE corrosion problems must be met in venting systems, many users find the trouble-saving answer in Transite "S" Pipe. Made of asbestos and cement, it cannot rust . . . successfully resists many corrosive fumes, vapors, dusts, gases, etc., encountered in industrial operations.

Strong and durable, Transite "S" Pipe can be used indoors or out—for ducts, vents or stacks. It is highly weather-resistant—needs no painting.

Installation of these modern asbestos-cement ducts is simple. Light in weight and readily assembled, Transite "S" Pipe comes in a range of 19 sizes, in diameters from 2" up to 36". A complete line of fittings is available.

* * *

For complete information, write today for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

Johns-Manville TRANSITE 'S' PIPE

may be used with either alternating or direct current. It is said to be well suited for making high speed horizontal or flat fillet welds over 4 in. long in which the coating can be dragged on both plates. It has also been used extensively for both vertical and overhead fillets, especially where large single pass fillets are desired. The ease of complete slag removal on square edge butt welds makes it useful for this type of joint. Complete penetration of ¼ in. plate can be obtained by welding one pass from each side, the manufacturer says.

This new electrode is available in the following sizes: 5/32x14, 3/16x14, ¼x18, and 5/16x18 in.

Hanlon-Waters, McAlear Merge

No. 2894—Hanlon-Waters, Tulsa, and McAlear Mfg. Co., Chicago, have integrated their operations and will conduct business as the Automatic Control Div. of Climax Industries, of which Climax Engineering Co. is also a division. The three companies, affiliated for the past year, have heretofore operated separately.

General management, sales, and engineering are also being centered under single heads. Edward F. Deacon, president, has announced the following new appointments: L. J. Griffey, vice president and general manager; M. C. Waterman, vice president in charge of engineering; C. W. Snyder, vice president in charge of sales.

The two plants and all branch offices and warehouses in the mid-continent oil field are being continued. In other territories sales will be handled through distributors. Export sales will be handled by General International, Chicago. Climax and McAlear trade names will designate all products in the future.

RETAILERS LAUD OUTSTANDING WORK of REFRIGERATION SERVICE ENGINEERS

This afternoon, in some distant city, a butcher with his walk-in cooler containing precious red-point meats, places a hurry-up call for a refrigeration service engineer — something is wrong with his refrigerating equipment.

The butcher faces loss of money, loss of meat and wasted points. But, this very night, a *refrigerating service engineer* works to set that equipment working again. Saving the butcher money, protecting his produce . . . helping him to stay in business.

On that service call, A-P DEPENDABLE Refrigeration Controls went along too. It's a fact, leading refrigeration service engineers depend on A-P DEPENDABLE Refrigeration Controls to help make their service calls 100% successful.

AUTOMATIC PRODUCTS COMPANY

2460 North Thirty-Second Street
Milwaukee 10, Wisconsin

Export Department, 13 E. 40th Street, New York 16, N. Y.

A-P Model 220 K Thermostatic Expansion Valve. Capacity to 16 tons Freon.

DEPENDABLE *Refrigerant Valves*

Stocked and Sold by Good Refrigeration Jobbers everywhere. Recommended and Installed by Leading Refrigeration Service Engineers.

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

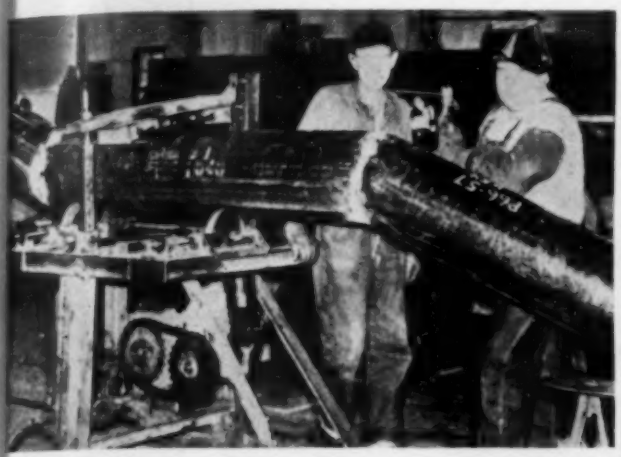
Many large users—installations total more than 5 million gallons per minute in water cooling and air condition ing service. Write for Bulletin N-416.

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA 18, PA.

YARWAY

Welder's Stand Speeds Work

No. 2895—The welding of odd shaped pipes for cargo ships and tankers has been greatly speeded up by a production suggestion of Fred Craytor, a welder at Marineship Corp., Sausalito, Calif., according to a report from the Hobart Bros. Co., Troy, Ohio.



A roller stand and positioner rotates the large, odd shaped pipe so that the welding is easily and quickly accomplished. This device consists of a stand, welded from steel salvaged in the shipyard, which holds the various sizes of pipe securely against drive rollers by pressure rollers. The speed of the drive rollers and the rotation of the pipe is controlled by a foot throttle

Vento Radiator Trap

The Strongest Thermostat Ever Built into a Steam Trap

HAINES TRAPS

THE operating member of Haines Traps is the famous Bourdon Thermostatic Tube, the strongest thermostat ever built into a steam trap. The Bourdon Tube is used in gauges where accuracy is paramount; therefore, they always give accurate performance. Haines Float & Thermostatic Traps are safe, no danger of building up a pressure, cannot become air bound. Can be examined under pressure. In ¾", 1" and 1¼" sizes.

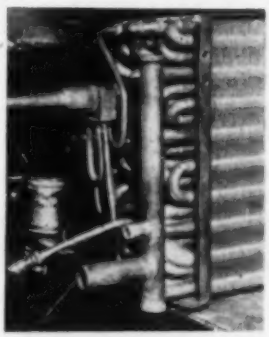
WM. S. HAINES & CO.
460 N. 12th Street
Philadelphia 23

F & T TRAP

GOOD NEWS

for the HEATING and AIR CONDITIONING industries -about SIL-FOS

With the recent lifting of restrictions on copper, SIL-FOS—the low-temperature silver brazing alloy—will soon again be available for civilian production.



The general use of SIL-FOS for fabricating heating and air conditioning equipment is well illustrated by this cooling unit made entirely by SIL-FOS brazing—Because SIL-FOS makes permanently leak-tight, maintenance-free joints, it is used on a vast scale for constructing non-ferrous pipe and tubing systems. WALSEAL fittings with SIL-FOS inserts (shown below) speed up the work.

THIS is welcome news to manufacturers and installers of heating and air conditioning equipment who know from prewar and wartime experience that SIL-FOS is ***in a class by itself*** for joining non-ferrous pipe and tubing and for fabricating non-ferrous metal parts.

From the physical standpoint, SIL-FOS is outstanding because it makes joints that are as strong and enduring as the parent metals and matches them in liquid and gas-tightness and in resistance to corrosion. Also, SIL-FOS's low flow point of 1300° F is a safeguard against heat damage, particularly when joining thin gauge metals.

From the economic standpoint, SIL-FOS is outstanding for speed, reliability and low cost.

YOU NEED THE ADVANTAGES OF SIL-FOS IN YOUR PEACETIME PRODUCTION

If you are not familiar with SIL-FOS, now is the time to find out what it can do for you, because the physical and economic advantages of SIL-FOS brazing are certain to be important factors in the keen competition for peacetime business.

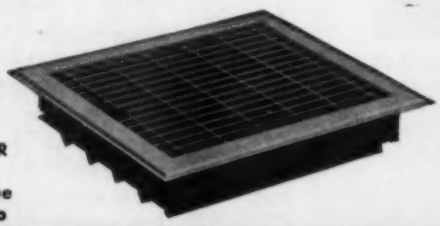
BULLETIN 12-A will give you the complete SIL-FOS story. Write for a copy—today.

HANDY & HARMAN
82 FULTON ST., NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

DuraBilt *Registers & Intakes*

DURABILT Floor Registers and Cold Air Faces have close mesh design in all models—½" by 2" on centers. Surplus strength results from amply heavy materials and rigid cross-bar assembly, the bars which form the face being mortised and locked at every cross joint, and securely interlocked to frame. Frame is welded and reinforced at corners, joints are close fitted and will not pull apart. Entire assembly is extra durable, tight and true, and faces are level and heel-proof. When stout, shock-proof construction is required—use DuraBilt!

To assist you in selecting registers for all purposes, write for Auer Register Book showing complete line of registers and intakes for warm air and air conditioning. Separate Grille Catalog "G" also sent on request.



THE AUER REGISTER COMPANY
3608 Payne Avenue
Cleveland 14, Ohio

AUER REGISTERS
& GRILLES · For Air Conditioning *and* Gravity

QUALITY always wins!
MARTOCELLO Products are fully **DEPENDABLE**

ATOMIZING SPRAY NOZZLES, SPRAY POND NOZZLES, and CONDENSER WATER DISTRIBUTORS
For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their Manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost.

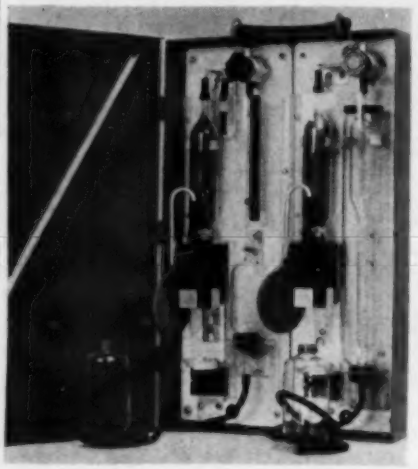
It will pay you to consult us. WRITE or WIRE for further information.

Jos. A. Martocello & Co. 229-231 NORTH 11th STREET PHILADELPHIA 7, PA

operated by the welder. This permits him to weld on top of the pipe, always in the most convenient down-hand position.

Gas Analyzer

No. 2896—The Hays Corp., 782 E. 8th St., Michigan City, Ind., has announced the development of a special analyzer ("series E") for testing the high purity of oxygen, carbon dioxide, and nitrogen in the range from 90 to 100 per cent.

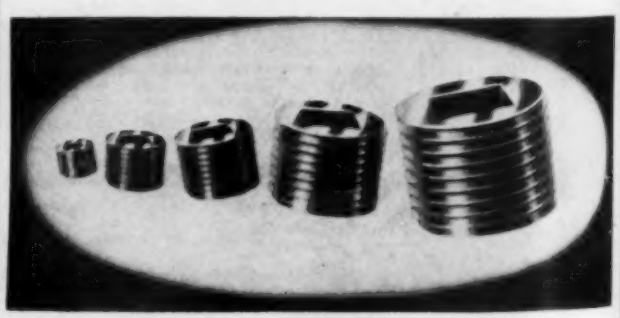


It is of particular interest to the manufacturers of commercial oxygen and carbon dioxide but has many practical uses also in industrial processes. The new analyzer came into being as the result of the demand for testing the high purity of oxygen for use in flying, etc. It is quite similar to the standard orsat but its technique in operation differs somewhat.

It is offered in two styles—a wall mounted model for permanent installation and a portable model supplied in a neat metal case with leather carrying handle. It may be had with a single unit or with two units. A junior model ("series EJ") is also obtainable with a burette capacity of 30cc. The smaller model measures 6¼ x 9⅝ x 3¾ in. and weighs, fully charged, less than six lb. All models feature a new four-way valve designed to conserve space and facilitate operation.

Countersunk Plastic Pipe Seals

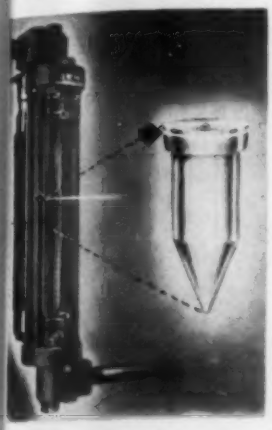
No. 2897—Plastic pipe seals and thread protectors in countersunk pattern have recently been announced by the American Molded Products Co., 1644 N. Honore St., Chicago 22, Ill. The plastic material takes accurate and



durable threading, is non-corrosive, dielectric, and excludes moisture, oil, dirt, grit, etc., says the manufacturer. The square sockets of the countersunk pattern are of dimensions to fit commercial square bars of standard sizes. Sizes available are ⅛, ¼, ⅜, ½, ¾, and 1 in.

Rotor for Flow Meters

No. 2898—For sharp, clear "Rotameter" readings of opaque liquids, the new "Line-o-Light" rotor is especially well suited, says the manufacturer, the Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa. This rotor has a disc of light transmitting material sandwiched in the rotor head which substantially reduces the distance that the light must travel through the opaque liquid from its source behind the tube. Rate of flow is thus delineated sharply in the resultant band of light on the tube reference scale.

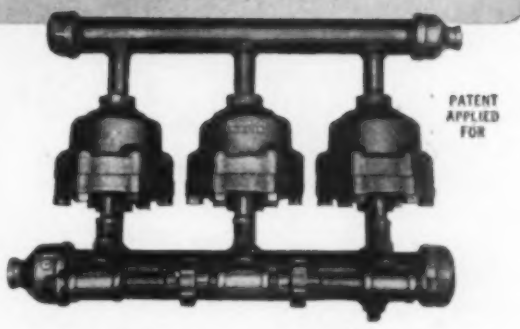


This rotor can be used for practically any application and in any tapered glass tube flow meter. Two types of discs can be furnished: "Lucite" for general applications and "Pyrex" glass for extremely hot or highly corrosive fluids.

Cutler-Hammer Names Officers

No. 2899—At a recent meeting of the board of directors, G. S. Crane, formerly vice president in charge of sales and engineering, was elected president of Cutler-Hammer, Inc., Milwaukee, Wis. F. R. Bacon, founder of the company, became chairman of the board. Other officers named at the meeting were: H. F. Vogt, chair-

Purify Any Pressures, Air or Gas, with Bird-White Multiple Unit *Pur-O-fier*



Three Models Available

Model A-1 furnished with a 1 inch turbo-rotor and will accommodate volumes from 1 to 8 cubic feet.

Model A-2 has a 2 inch turbo-rotor and can accommodate volumes from 10 to 35 cubic feet.

Model A-4 has a 4 inch turbo-rotor and can accommodate volumes from 35 to 100 cubic feet.

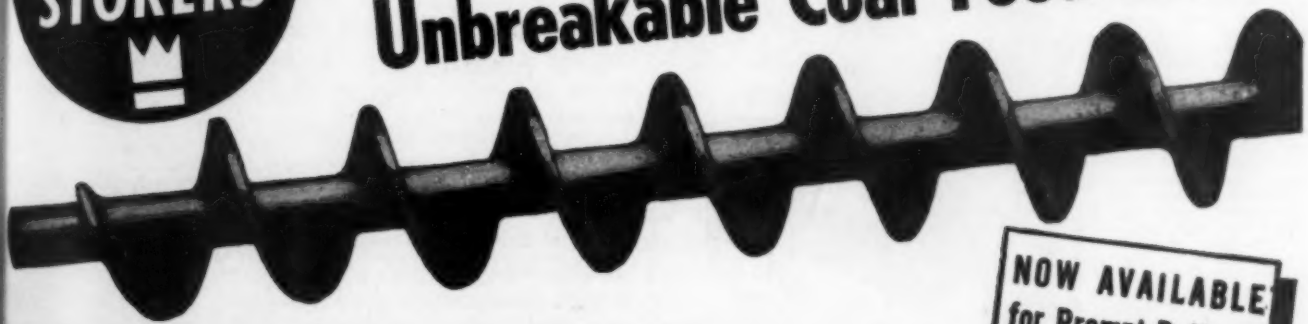
Bird-White multiple unit Pur-O-fiers save time and money by protecting air-operated machines, gauges and controls from contamination. They give positive purification to air or gas lines regardless of fluctuating pressures or high volumes.

The perfectly balanced Turbo-Rotor purifying action makes them sensitive to both regular and intermittent pressures. Write for Bulletin 10 giving complete details.

BIRD-WHITE COMPANY
Dept. HP, 3119 W. Lake St., Chicago 12, Ill.

For STOKERS

The CROWN Unbreakable Coal Feed Screw



NOW AVAILABLE for Prompt Delivery

WELDED All-Steel Worm—All Sizes—All Pitches

★ Crown's complete line of all-steel Coal Feed Screws meets every replacement and production requirement. Produced for both domestic and industrial stokers. Crown Screws are available with right or left hand screws, in all sizes and pitches, tapered or straight, and in combinations of pitches. Uniformly smooth surfaces insure that coal will flow freely and easily through the flights. Because it is all-steel with continuous weld, the Crown Coal Feed Screw guarantees long, continuous operation with full customer satisfaction. Crown is in a position to make prompt delivery on all sizes.

In ordering give complete specifications on size and design.

CROWN IRON WORKS COMPANY
1202 Tyler St., N. E. *Since 1878* Minneapolis, Minn.

"COMMERCIAL"
VENTURI TYPE
FAN HOUSING

Twelve sizes now available ... free from die charges.

Venture section and support plate are formed in one piece ... no folds or welds.

These sections are formed cold ... dimensions are uniform.

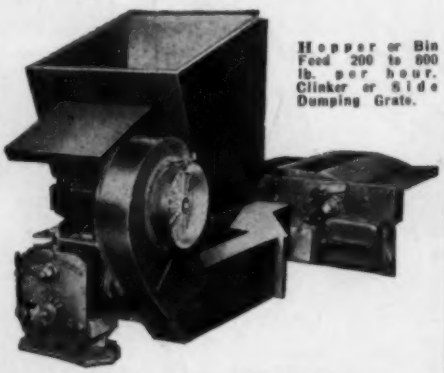
Write for folder giving full dimensions.

THE COMMERCIAL SHEARING AND STAMPING COMPANY
YOUNGSTOWN 1, OHIO

DON'T PLACE THAT ORDER!

BEFORE YOU INVEST IN A STOKER
INVESTIGATE THE FREDERICK . . .

Frederick Stokers deliver maximum amount of heat from every ton of coal consumed. This is due to Frederick *design* which insures (1) thorough fuel combustion (2) maximum utilization of heat-giving gases and (3) results in less coal burned and more heat generated. Frederick Stokers are constructed to withstand the rough usage of industrial installations. Send for the stoker catalog and find out about Frederick *engineered* features—



Hopper or Bin Feed 200 to 800 lb. per hour. Clinker or Side Dumping Grate.

A—Fully active grate surface . . . no dead plates.
B—Continuous speed type transmission.
C—Completely enclosed windboxes and mechanism.

For these and other reasons the Frederick Stoker is highly regarded and widely used. Write for catalog . . . today.

WE ALSO MANUFACTURE fine Centrifugal Pumps . . . especially designed for efficient service in a specific industry. Engineering consultation available without obligation.

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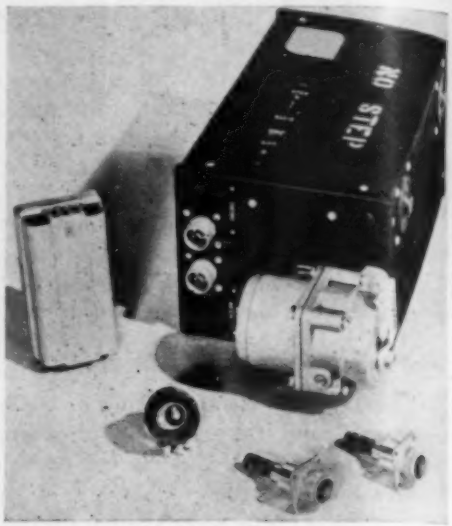
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

man of the executive committee and vice president and treasurer; J. C. Wilson, vice president and secretary; P. B. Harwood, vice president in charge of engineering; P. S. Jones, vice president in charge of sales; Philip Ryan, vice president in charge of manufacturing; and E. W. Seeger, vice president in charge of development.

Electrons Regulate Plane Temperatures

No. 2900—Postwar air travelers may depend upon tiny coils of wire and electron tubes to keep warm while roaring through the substratosphere, says the Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, 8, Minn. The device is known as the "Electronic Cabin Temperature Control System" and has been in test service on several airlines and combat use on Army transport ships for some time.



This system is a package unit weighing slightly under 8 lb and is designed to hold automatically any cabin temperature selected by the pilot. Connected to the master control switch in the cockpit, the control system is automatically turned on when the pilot starts the engines. The heating system remains inoperative unless temperatures fall to a point requiring the addition of heat for passenger comfort. At this point, without any attention from the pilot, the heating system starts delivering heat to the cabin in the amounts needed to maintain the pre-selected temperature—usually 70 deg.

The system includes an outside air compensator, a small coil of wire installed in the duct bringing outside air into the plane's heaters. Temperature fluctuations change the electrical resistance of the wire, and although this change is only slight, it can easily be measured through electron tubes. According to the manufacturer, the tubes learn from the coil that the outside air is colder or warmer, and send electrical messages to a motor which opens or closes a mixing damper and thus proportions the amounts of outside air with heated air from the plane's heaters.

The system also includes a "cabinstat," which is another coil of wire mounted in the cabin and serving about the same function as a thermostat in a house. This, too, interprets temperatures and sends messages to the electron tubes which, getting signals from both coils, position the mixing damper to maintain the selected inside temperature. The latter is determined by a small dial mounted in the cockpit.

Blower Cools B-29 Power Unit

No. 2901—A special single inlet fan wheel, manufactured by the Lau Blower Co., 2001 Home Ave., Dayton 7, Ohio, cools the accessory power unit of the B-29 Superfortress. So large is the B-29 that it requires over 140 small electric motors to drive the various mechanisms, such as bomb bay doors, radio, etc.

The power for these operations is supplied by an accessory power plant. This power plant also serves as an emergency standby source of power in flight when part of the electrical system has been shot out or when one or more of the main engine generators become inoperative. Thousands of these special fan wheels are being mass produced for the B-29s that are being added to our Pacific air fleet.

NEW HANDBOOK
SIMPLIFIES SELECTION AND APPLICATION OF AIR DIFFUSERS

FREE: To those responsible for air diffusion "design."

And to those who install the equipment and are responsible for its performance.

FREE: New Engineering Data on the art of Air Diffusion in general and the proper application of KNO-DRAFT *ADJUSTABLE* DIFFUSERS in particular.

Performance Data
Selection Charts
Air Capacity Tables with Instruction sheets
Damper Setting Chart
Air Direction Adjustment Chart
Standard Specifications
Complete Price List

IT CONTAINS clear sketches, charts, dimension prints and instructive text for quick, accurate SELECTION – APPLICATION – LOCATION – ASSEMBLY – ERECTION – TESTING – ADJUSTMENT of air diffusers and of ACCESSORY EQUIPMENT such as dampers, air equalizing grids, mounting rings and air sectorizing baffles.

All set up in durable loose-leaf binder to facilitate the insertion of supplementary or revised data which will be forwarded from time to time to those who have sent for this catalog. Write for your free copy to Department D-6.

W. B. CONNOR ENGINEERING CORP.

114 E. 32nd Street — New York 16, N. Y.

CONNOR

EASIER - SIMPLER - LOWER COST
BEAR
DY-NAMIC BALANCING

For All Rotating Parts

Chase Away the WOBBLIES

And You Eliminate Product-Life-Destroying Vibrations and Excessive Wear

DY-NAMIC BALANCE for all rotating parts will be a Post-War MUST! But it's no longer a tedious, difficult task to "drive out the WOBBLIES". Bear Dy-Namic Balancers do the job easier, faster and at lower cost. Available in many models and sizes, Bear Balancing Machines dy-namically balance *any* rotating part . . . fans, blowers, motors, armatures . . . even railroad car wheels . . . from 4 oz. up to 4000 lbs.! Used by hundreds of leading manufacturers in over 20 industries. Bear lower-priced, easy-to-operate Balancers solve your vibration problems FAST!

SEND FOR THIS NEW CATALOG. *Describes Bear Dy-Namic Balancers ranging from bench models to heavy duty and pit models. Explains need for Dy-Namic Balancing your products, production machinery and in the repair and maintainance of equipment with rotating parts. When you send for catalog, tell us the details of your balancing problems. Address Bear Mfg. Co., Dept. HPA, Rock Island, Illinois.*

750

BEAR DY-NAMIC BALANCING MACHINES

EFFICIENT
ECONOMICAL

De Luxe type WK Pressure Actuated Water Regulating Valves for Freon, Sulphur or Methyl, are pilot operated, modulating. Standard adjustable opening range from 50 to 150 lbs. Factory set to open at 90 pounds. Precision engineering and individual testing for low cost, satisfactory performance. Available in sizes of ¾ to 2 inches FPT. Simple adjustment—easily serviced.

Other sizes and types are also available.

Electrimatic
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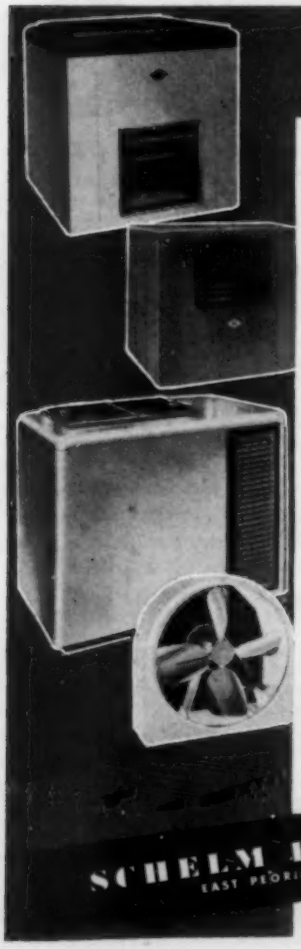

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The famous HALL line of Air Cooling Units, Low-temperature Cabinets, Furnace Blowers and Attic Fans are manufactured by

SCHELM BROTHERS Inc.
EAST PEORIA 8, ILLINOIS

Chicago Sales Office
1737 Howard Street
Chicago, Illinois

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 133. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Armored Indicating Meters

No. 5013—Armored "Rotameters" are the subject of a new 14-page catalog (43-E) issued by the Fischer & Porter Co., 7344 County Line Rd., Hatboro, Pa. It describes armored indicating meters and also recording, recording controlling, and totalizing armored meters. There are illustrations of many designs to accommodate pressures as high as 10,000 psi and temperatures up to 750 F.

Asbestos Air Duct

No. 5014—"Careyduct," a readymade all asbestos air duct, is briefly described in a 12 page folder (5212) recently issued by the Philip Carey Mfg. Co., Wayne Ave., Lockland, Cincinnati 15, Ohio.

Automatic Refrigerant Control

No. 5015*—A 68 page handbook of information and data for the commercial refrigeration and air conditioning contractor, dealer, and service engineer has been made available by the Alco Valve Co., 865 Kingsland Ave., St. Louis 5, Mo. This booklet, which contains many tables and diagrams, emphasizes the control of refrigerant in the system without attempting to treat the whole subject of refrigeration. Terms, definitions, and discussions are phrased in simple terms wherever possible.

Control Tower Air Conditioning

No. 5016—Weather Magic (Vol. 9 No. 2), house organ of the Trane Co., La Crosse, Wis., contains an interesting story on air conditioning systems for airplane control towers, which were designed for the Army Air Force.

Corrosion Resistant Materials

No. 5017—A 15 page bulletin (H) recently published by the U. S. Stoneware Co., Tallmadge Circle, Akron, Ohio, describes corrosion resistant materials and equipment, including tank linings and lining materials, tubing, gasketing, paint, chemical stoneware, and corrosion resistant masonry.

Dust and Spray Hoods

No. 5018—A four page folder describing full vision type respirator hoods for dust and spray has been issued by the Industrial Products Co., 2888 N. 4th St., Philadelphia, Pa. Five types for light and heavy duty are described.

Electronics

No. 5019—To help provide an understanding of the

*Price 50c. Write manufacturer direct.

principles of electronics and its role in industrial development, the Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., has recently published a 20 page booklet (E6358) entitled Introduction of Electronics. Included are principles of tube detector action with applications, and principles of tube oscillators with application to induction and dielectric heating. The book is illustrated with line drawings, curves, and sketches.

Electronics

No. 5020—A 32 page booklet outlining the basic facts about electronics has been issued by the Electronic Corp. of America, 45 W. 18th St., New York 11, N. Y. Cartoons illustrate the text, which is written in simple language.

Fin Type Radiators

No. 5021—"Vulcan" fin type steel radiators are described in a four page bulletin (14) recently published by the Vulcan Radiator Co., 26 Francis Ave., Hartford 6, Conn. Ratings per lineal foot are included, as well as a general description and photographs of typical installations.

Flow Meters

No. 5022—The use of a "Rotameter" in flow rate measurement is illustrated and described in a 32 page revised catalog (10-C) of the Fischer & Porter Co., 7344 County Line Rd., Hatboro, Pa.

Flow Meter Theory

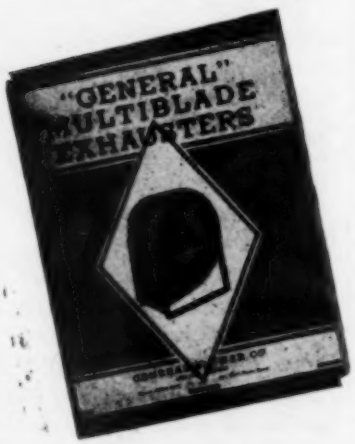
No. 5023—A new 24 page edition of its catalog

The General Says

ATTENTION

Write today for the complete information which General Blower Co. has prepared for you regarding

GENERAL MULTIBLADE EXHAUSTERS



Ask for Portfolio SC-101—H.P.A.

DELIVERIES 2½ WEEKS

GENERAL BLOWER COMPANY

Producers of Air Moving Equipment

401 North Peoria St. Chicago 22, Illinois

Venting Overhead Hot or Cold Water Circulating Lines.

Circulation Troubles?

Don't fight air pockets or traps in hot or cold circulating lines. "Get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, convector radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids. Now available in bright brass finish. For pressures up to 75 pounds.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE

MAID-O'-MIST INC.

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AUTOMATIC HUMIDIFIERS
ALL-TYPES HEATING SYSTEMS

HAYS AIR-FILTER GAGE

- *Automatic*
- *EASY TO INSTALL*
- *SAVES MONEY*
- *ELECTRICALLY OPERATED*

If you are confronted with the problem of not knowing when the collected dirt in your filters is of sufficient density to decrease operating efficiency, install a HAYS Air-Filter Gage. The HAYS indicator shows amount of air resistance at all times—tells when to renew filter element—eliminates guess work—can be made to sound alarm when resistance is excessive. Write for full information. Ask for HAYS Bulletin A-F G.

The HAYS CORPORATION

COMBUSTION INSTRUMENTS AND CONTROL

MICHIGAN CITY, INDIANA, U.S.A.

Janette

D.C. to A.C. CONVERTERS

.1 to 3.2 K. V. A.

The Janette Rotary Converter is a simple, practical method for obtaining Alternating Current when only D. C. power is available.

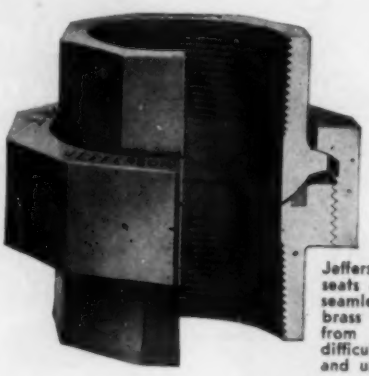
Janette was one of the first manufacturers to build converters especially for use with A.C. electronic tube devices. Since their inception these machines have established a world wide record for reliable, efficient, quiet, trouble free operation, under the most adverse conditions.

TWO TYPES are available; one for commercial applications, the other for marine service. Special filters for suppressing conducted and radiated noise voltage interference can be supplied.

If you want a really dependable converter, guaranteed for one year, we suggest you **TRY A JANETTE!**

May We Send Literature?

Janette Manufacturing Company
556 W. Monroe St. Chicago 6, Ill.



Jefferson Union seats are cut from seamless drawn brass tubing, free from all casting difficulties, sound and uniform!

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(98-Y), on the theory of the "Rotameter" has recently been issued by the Fischer & Porter Co., 7344 County Line Rd., Hatboro, Pa. It covers such subjects as the history and development of the area-type flow meter, and includes technical and engineering data together with many diagrams and illustrations.

Flow Rate Measurement

No. 5024—A nomograph (G-16080) for determining correct "Rotameter" size for steam measurement has been issued by the Fischer & Porter Co., 7344 County Line Rd., Hatboro, Pa. Specifications are given for indicating, recording and controlling, and remote recording and controlling types.

Gas and Air Flow Regulator

No. 5025—The Hagan Corp., 600 Bowman Bldg., Pittsburgh 30, Pa., has recently issued a four page bulletin (1145) describing the operation and characteristics of the company's type "SO" regulator for the control of suction, pressure, or flow in any gas or air flow system. Included are a cutaway drawing, a blueprint giving outline dimensions, and a description of construction features.

Gas Control System

No. 5026—A 45 page service and instruction manual (Fl-101) for the "B-60" all gas control system has recently been published by the General Controls Co., 801 Allen Ave., Glendale 1, Calif. The handbook includes a general description; installation, maintenance, and repair instructions; adjustment and test procedures; and a parts catalog section. Schematic drawings, cutaway views, and diagrams illustrate the text.

Graduate Training for Engineers

No. 5027—A training course permitting exploration by the graduate engineer of production, sales, research, design, field work, and other elements of industrial operation is outlined in a 15 page illustrated training brochure (E6085-A) published by the Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Heat and Vent Valve

No. 5028—The "Aero" heat and vent valve for air and heat control is described in a four page bulletin issued by the Smith-Mautz Co., 230 S. Orange St., Glendale 4, Calif. Included are specifications, dimensions, operating information, and the results of laboratory tests. Construction of this valve is similar to a camera shutter.

Melting Snow by Piping

No. 5029—Snow melting by means of underground hot water or steam wrought iron pipe lines is the subject of a 6 page case study (4) issued by the A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa. Design and installation practices are described, and specific information is given on five installations.

Mineral Wool Insulation

No. 5030—High and low temperature mineral wool insulations are described in a new 25 page catalog issued by the Baldwin-Hill Co., 531 Klagg Ave., Trenton

, N. J. Included are application specifications, conductivity curves, and engineering data, together with many illustrations.

Motors and Transformers

No. 5031—A 16 page illustrated folder (GU-86) has recently been issued by the Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo., describing briefly its entire line, which includes motors, transformers, industrial brakes and controls, etc.

Open and Closed Heat Exchangers

No. 5032—Closed heat exchangers and converters, open heat exchangers, and instantaneous and storage hot water generators are illustrated and described in a four page bulletin (H-1) published by the Brownell Co., 300 N. Findlay St., Dayton 1, Ohio.

Overfeed Stoker

No. 5033—The "Carburetor" stoker, which embodies the overfeed, portable, guntype principle, is described in a four page reprint issued by the Woolley Engineering Co., 412 Curtis Bldg., W. Grand Blvd., at Hamilton, Detroit, Mich. A line drawing illustrates the mechanical principles of the stoker and specification suggestions are also given.

Oxygen in Industry

No. 5034—A 24 page illustrated booklet (ADG-2014) recently published by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., tells the story of how oxygen is made and how it is used in industry. Dif-

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ferent types of "packages" for varying oxygen volume requirements, operating conditions, and internal plant gas distribution methods are all described, and there are also sections on welding, flame hardening, flame cleaning, underwater cutting, hand and machine gas cutting, and other flame processes.

Personnel Practices

No. 5035—The historical development and results of its employee policies are described by the Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago 41, Ill., in a 12 page booklet. Among the personnel practices which the company helped to pioneer are a profit sharing plan, paid vacations, a stockholding plan, hospitalization, and retirement annuities.

Powder Metallurgy

No. 5036—General information on powder metallurgy, design recommendations, and technical data on metal powder parts are contained in a 56 page manual published by the Moraine Products Div., General Motors Corp., Dayton 1, Ohio. These data are presented with the aid of many charts, photographs, and diagrams.

Product Directory

No. 5037—A 32 page directory (B6057) of products and engineering information has been issued by the Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. More than 1600 product types are listed. Products added since the previous directory, such as induction and dielectric heating equipment, are indicated by stars. Engineering literature is arranged according to product discussed with new bulletins also starred.

Pump Engineering

No. 5038—The engineering application of centrifugal pumps is the subject of a 416 page data book published by Economy Pumps, Inc., 1000 Weller Ave., Hamilton, Ohio. Some of the subjects covered are the following: principles of pump engineering; testing of centrifugal pumps; specific speeds of centrifugal pumps; model tests; suction lift of centrifugal pumps; friction of water in pipes, both iron and brass; loss of head through valves and fittings; measurements of water by weirs, nozzles, orifices, etc.; selection of material for corrosion resistance; general properties of metals and alloys; dimensions of pipe and flange fittings, 25 to 600 psi; motor wiring tables; approximate efficiencies, power factors, etc., of electric motors; capacity of drainage and water supply pumps for buildings, swimming pools, etc.; discussion of paper stock pumping; irrigation, golf course watering, etc.; weights and specific gravities; circumferences and areas of circles; catalog data with efficiencies and prices of centrifugal pumps and prices of electric motors, controls, pump accessories, etc.

This book is intended to include sufficient data to enable the user to solve all ordinary pump problems. It is distributed free to pump users and engineers; to others, the price is $2.00.

Push-pull Lock Control

No. 5039—A one page engineering bulletin (10) recently issued by Arens Controls, Inc., 2267 S. Halsted

St., Chicago, Ill., describes a new tension lock control—a lightweight push-pull control unit. Included are an engineering drawing, specifications, and a description of the unit's operation.

Radiant Heating

No. 5040—An application of radiant heating in an industrial garage is the subject of a four page case study (5) issued by the A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa. Details of design, installation, and costs are given, together with engineering data and the results obtained from operation for the first heating season. Photographs show overall sections and close-up details.

Refrigeration Compressors

No. 5041—Gas engine refrigeration compressors are described in a 12 page bulletin (C-1100-B21); steam engine driven compressors in 14 pages (B22); single cylinder booster models in six pages (B23); and a fourth bulletin (B-27) deals with evaporative coolers. All of these bulletins, recently issued by the Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J., contain photographs, specifications, and operating data.

Ship Ventilation

No. 5042—"Cargocaire," a system of mechanical ventilation, recirculation, and humidity control of the air in a ship's hold, is described in an eight page bulletin published by the Cargocaire Engineering Corp., 75 West St., New York, N. Y. A profile view of an installation in a ship serving tropical ports is included.

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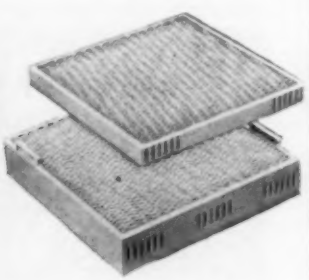

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Specially Designed for extra heavy duty and industrial air cleaning services, the BADGER Heavy Duty Permanent Filter provides definitely improved air filtering, lower air resistance, greater dust-holding capacity, as well as reduced costs of maintenance. In addition, longer filter life is assured. Built in 2" and 4" sizes.

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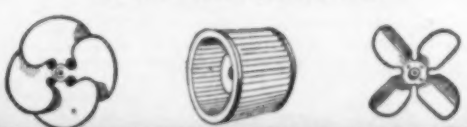

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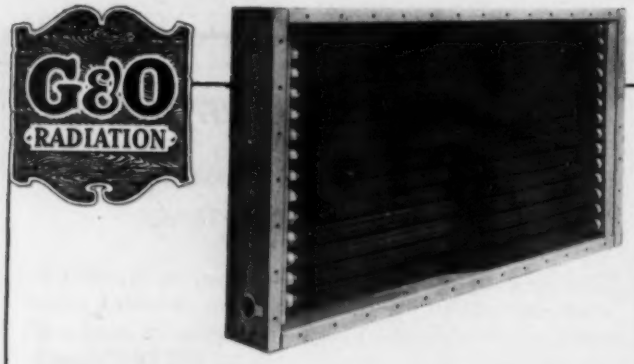

Detail of mechanical joint used in Universal Heat Transfer Coils.

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WRITE today for literature and dealer plan.

A GEHL WINS FRIENDS WHEREVER IT GOES

Silicone Rubber

No. 5043—The properties of "Silastic," a new elastic silicone product, are described in a four page folder issued by the Dow Corning Corp., P. O. Box 592, Midland, Mich.

Small Heat Exchangers

No. 5044—A 20 page illustrated bulletin (58) on "Heliflow" small heat exchangers has been published by the Graham Mfg. Co., Inc., 415 Lexington Ave., New York 17, N. Y. Single coil, multiple coil, and multi-coil types are described.

Soundproof Fan Bases

No. 5045—A nine page bulletin issued by the Korfund Co., Inc., 48-36 32nd Pl., Long Island City 1, N. Y., describes a new twin rail vibration and soundproof fan base. Included are six full scale diagrams, as well as photographs and construction details.

Steam Vacuum Refrigeration

No. 5046—A 15 page bulletin (60) issued by the Graham Mfg. Co., Inc., 415 Lexington Ave., New York 17, N. Y., contains a general description of the principles of steam vacuum refrigeration, types of coolers and applications, specifications, together with photographs and diagrams of the equipment.

Temperature Exchanger

No. 5047—A new temperature exchanger is described in a bulletin (12) published by the Bird-White Co., 3119 W. Lake St., Chicago, Ill. Engineering drawings show multiple installations for air or gas lines, and complete specifications and capacities of each model are listed.

Thermometers, Recorders, and Controllers

No. 5048—The Gotham Instrument Co., 149 Wooster St., New York 12, N. Y., has published a new 32 page catalog (45) describing its line of industrial indicating, recording, and controlling thermometers. Included are specifications, standard dial ranges, structural features, temperature conversion tables, and other data.

Traction Type Dynamometer

No. 5049—A 19 page manual published by W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill., tells the story of the traction type dynamometer and the increasing number of uses which are being found for it in testing and weighing procedures. Many applications of the instruments are illustrated with on-the-job photographs.

Vibration Control

No. 5050—The effect of vibration in industry and the means of controlling it are discussed in a 12 page bulletin (SP 650) issued by the Korfund Co., 48-36 32nd Pl., Long Island City 1, N. Y. Materials and engineering methods of vibration control are illustrated and described.

Welding Positioner

No. 5051—Operating information on its welding positioner is given in a four page folder recently issued by the Standard Machinery Co., Providence 7, R. I. Photographs and line drawings illustrate the text.

Westinghouse Acquires B. F. Sturtevant Co.

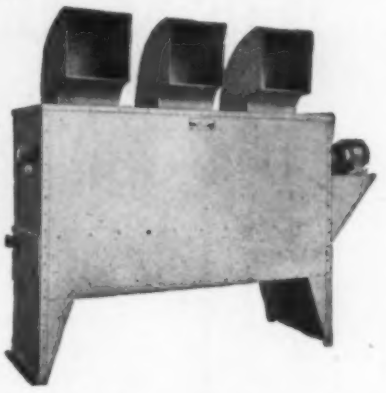
Acquisition of the B. F. Sturtevant Co., of Boston, Mass., pioneer in the design and manufacture of air handling and processing equipment, has been announced by A. W. Robertson, chairman of the Westinghouse Electric Corp. The Sturtevant company becomes a wholly-owned Westinghouse subsidiary, operating as the B. F. Sturtevant Co., a division of Westinghouse Electric. Management of Sturtevant will be assumed by Westinghouse about September 1.

"The uniting of Sturtevant's mechanical and air handling experience with the Westinghouse developments in air conditioning and our complete resources in the electrical field," Ellis L. Spray, vice-president in charge of the air conditioning and elevator divisions of Westinghouse, said, "will result in the most complete organization in the air conditioning and air handling industry."

The Sturtevant company's products cover a wide range in the fan and blower field, heating, cooling and air conditioning apparatus, including application and design of complete air handling and processing systems for industry.

"The headquarters of the expanded Westinghouse air conditioning activities will be located in Boston," Mr. Spray said. "However, heavy duty and industrial refrigeration manufacture will continue at Jersey City, N. J., along with production of the 'Precipitron.'

"Acquisition of the Sturtevant company is the latest step in Westinghouse's preparations to meet postwar expansion in the air conditioning and related fields," Mr. Spray pointed out.



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HERE'S WHY—

GRID UNIT HEATERS *are different!*

*One piece construction heating sections (patented) of high test cast iron that withstand steam pressure up to 250 lbs.

*No soldered, brazed, welded or expanded connections to become loose or develop leaks.

*No electrolysis to cause corrosion, breakdowns, leaks, or heating failures.

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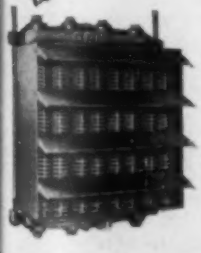

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1. Can be easily installed in partially filled tanks.
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Do it *Quicker Easier* with Tal's Prestal Pipe Bender

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You start saving valuable working time and reduce material costs the day you use a Tal Prestal Pipe Bender. This efficient, easy to operate, portable machine reduces by 60% the need for fittings or welds. It bends ⅜" to 3" wrought iron or steel pipe up to 180°, cold, in one single, fast operation without moving the pipe, without heating or filling. With a Tal Bender you get a job to be proud of, neat, smooth, workmanlike, free from kinks or wrinkles. Hundreds of leading contractors already know that this best engineered, money making machine repays its low cost over and over every few months. Write for bulletin... today!

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STANDARD STAMPING & PERFORATING CO.
CHICAGO ILLINOIS

Refrigerated Concrete

Refrigerated concrete—four and a half million tons of it—is safeguarding the towering walls of Fontana Dam and helping to speed up completion of one of the largest of the wartime TVA river projects.

The refrigeration installation, engineered by the York Corp., Roosevelt Ave., York, Pa., will prevent the formation of millions of small cracks in the face of the dam which ordinarily occur over a period of years as the chemical heat in a large mass of concrete cools off. Such heat may rise as high as 30 F above the surrounding temperature and may take 50 years to subside. Artificial chilling will cut this cooling time to two or three years, it is believed. In summer concrete temperature may go as high as 80 deg and in winter to 60 deg, but since the new concrete is somewhat plastic, the expansion as a result of this heat causes no damage, it is said.

Miles of lateral 1 in. piping stretched across the face of the dam walls, from the ground to the top of the 480 ft spillways, now cool the concrete with an average of nearly 4000 gpm of chilled water. Approximately 250 tons of refrigeration a day are supplied by two compressors on one system and a second system pumps cool river water direct to the concrete by means of four pumps. Chilled water supply ranges in temperature from 40 to 50 deg with the low point set at 35 deg in winter.

In order to prevent an excessive heat problem, Fontana Dam is built up from small blocks of lifts of concrete, each 5 ft high and 50 ft long with joints in between to provide for expansion. Lateral cooling pipes are spaced up the side of the structure about 6 ft apart. In unusually warm weather, size of individual blocks is reduced to two and a half feet in height in more critical zones to further reduce the danger of cracking. Without any form of artificial cooling, the blocks in the dam would have to be made even smaller at a greatly increased cost and loss of time.

Interior concrete temperatures are constantly measured by inserting portable thermometers into pipes imbedded in the walls at intervals of 25 ft in some sectors. These data enable engineers to vary the flow of cool water to various sections to keep a constant balance.

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DESIGNED FOR COOLING TOWERS AND EVAPORATIVE COOLERS. HAS MANY OTHER USES

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SIMPLE IN OPERATION
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Materials corrosive resistant, IRIDITE PLATED. Non Water Absorbing POLYSTERENE FLOAT. Will flow 70 G.P.H. at 20-lb. Pressure, 195 G.P.H. at 80 lbs. Packed in cartons of 12. Usual Trade Discounts.

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